

AQUATIC SURVEY OF SELECTED STREAMS WITH CRITICAL
HABITATS ON NATIONAL RESOURCE LANDS AFFECTED
BY LIVESTOCK AND RECREATION



# CENTER FOR HEALTH

# AND ENVIRONMENTAL STUDIES

Brigham Young University



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AQUATIC SURVEY OF SELECTED STREAMS WITH CRITICAL
HABITATS ON NATIONAL RESOURCE LANDS AFFECTED
BY LIVESTOCK AND RECREATION

January 6, 1976

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Prepared for:

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January 6, 1976

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#### PURPOSE OF STUDY

The purposes of these surveys are to provide aquatic habitat and water quality baseline data to the U. S. Bureau of Land Management (BLM) to be used in the evaluation of: (1) livestock grazing impacts on the flora and fauna of Big Creek, Birch Creek, Thoms Creek, and Trout Creek; and (2) impacts from increased recreational use on the potable water supply and aquatic ecosystem of Rock Creek within Desolation Canyon. These baseline data are to be used in management decision formulation by the BLM for the management of land/water resources on national resource lands (NRL) in Utah.

To be included in the analysis of data from these surveys are: a review of existing surface water records, flows and quality; descriptions of existing aquatic habitats; characterizations of macroinvertebrate communities; and water quality summary for each stream. These data will provide the baseline inventory relating to the specified streams within the Salt Lake, Cedar City, and Moab Districts of the Bureau of Land Management. The assemblage, analysis, and recommendations presented as a result of this study will form the basis for land management decisions and future studies involving aquatic habitats and related fauna in these streams, especially in areas of recreational and livestock grazing impacts.

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# METHODS AND MATERIALS

# Aquatic Habitat

The methods used for aquatic habitat surveys were those described in the preliminary draft BLM manual supplement, Utah State Office 6671--Aquatic Studies (1974) by Don Duff, Fisheries Biologist, Utah State Office, Bureau of Land Management, Salt Lake City, Utah.

## Water Quality

Specific conductance and water temperature were measured in the field using a YSI meter. Air temperature was measured with a mercury thermometer. Dissolved oxygen was determined by a modified Winkler Method. Narrow range indicators and a Sargent pH meter were used for pH determinations. Other water chemistry measurements were all completed by one of two Utah Division of Health certified water quality labs: BYU Environmental Analysis Laboratories and U.S. Geological Survey laboratory.

Bacteria samples were analyzed by either Bionics (a certified laboratory in Provo), BYU Environmental Analysis Laboratory, or the Utah State Division of Health Laboratory in Salt Lake City.

# Macroinvertebrates

A stratified random method was used in sampling benthic macroinvertebrates. Three or four quantitative samples were "randomly" taken from preselected habitat zones for each area being sampled. Preferred habitat was gravel-rubble riffles when available. The gravel-rubble was sought out because aquatic invertebrates are found in higher diversity in these substrates than in most other bottom types. The sampler used was a modified Surber designed to prevent loss of organisms due to backwash out of the net. Invertebrates were separated, identified, and counted. A list of taxa, numbers per meter square, and two dominance diversity index values for each site for each date were calculated. At one site per stream, a step analysis was completed, including mean number per sample, standard diversity of the means, 80 percent confidence limits, the percent standard error of the mean, the coefficient of variance, d and H diversity indices, and the number of taxa. Standard errors should be 20 percent or less of the mean and the coefficient should be less than 50 percent. Step one is based upon only one sample; Step 2 is based upon two pooled samples; Step 3 is based upon three pooled samples; and so forth.

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An often used measure of the well being of aquatic communities is the diversity index. The diversity indices are highest (most desirable) when the number of species is high and the number of individuals is evenly distributed over several species. With fewer species or when one or two species account for most of the total number, the diversity indices are low (undesirable). For example, when a stream receives a heavy load of sewage effluent, most mayflies, stoneflies, and caddisflies are eliminated; but the number of midge larvae and sewage worms become extremely high. In such a condition, the diversity index would be low. In clean, cold mountain streams there are usually numerous species of aquatic insects with moderate numbers of individuals for several species, resulting in high diversity indices. Dominance diversity values in this report were computed using the formulas:

$$\overline{d} = -\sum_{i=1}^{S} (N_i/N) \log_2(N_i/N) \text{ (Shannon and Weaver, 1963)}$$

$$H = (i/N)(\log N! - \sum_{i=1}^{S} \log N_i!) \text{ (Brillouin, 1960)}$$

Where:  $\bar{d}$  and H are dominance diversity indices N = number of the i'th species  $N^i = \text{total number of all species}$ 

Both indices are very similar and are both based upon the information theory. In summary, when several specimens of a sample are examined, more information is gained when the next specimen examined is different from the preceding one than if they were all the same. Thus, these formulas were selected because they are based upon diversity dominance and express the relative importance of each species collected, not merely the relationship between total numbers of species and of individuals. These indices are also independent of sample size.

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#### STUDY AREAS

### Streams Under Grazing Impact Analysis

# Big Creek

Salt Lake District, Rich County, near Randolph, Utah (Figure 1). This study reach occupies that stream area immediately above, within, and below an existing Bureau stream improvement demonstration area exclosure in T 10N, R 6E, Section 19 (Figure 2). This stream improvement demonstration area is inhabited by cutthroatrainbow hybrid species. The improvement structures and exclosure were installed in 1970 to show recovery over time of the riparian aquatic ecosystem from the impacts of livestock grazing uses and to evaluate the effectiveness of artificial structures in improving fisheries habitat. The improvement site is still subject to periodic sedimentation from unstable upstream reaches originating on private and NRL. The Cache National Forest boundary is approximately 4 miles above the study site and contains the headwaters of Big Creek. Comparisons of aquatic conditions in the exclosed area to those found above and below the exclosure in continued grazing use areas, will help define future management alternatives for the area.

The watershed consists mainly of a west to east slope of Tertiary Wasatch (Knight) sedimentary formation with some limited exposures of Twin Creek limestone in the headwaters and alluvium and Lake Bonneville deposits in the valley around Randolph, Utah.

In the study area the dominant vegetative community is sagebrush-grass with a few small patches of willows next to the stream. There are a few scattered junipers on the gradual sloping hillsides and some clones of quaken aspen farther up near the hill crests.

The area appears to have been subjected to heavy grazing pressures, especially along the streambanks. Most of the willows are cropped off to bare stems and extended shoreline reaches are barren of any shrubs or tall grasses or weeds.

Big Creek is a major source of irrigation water and also drinking water for livestock and wildlife. The stream in the study area provides angling opportunities for sportsmen from a catchable rainbow trout fisheries managed by the Utah Division of Wildlife Resources, but production of the natural in-stream propagated cutthroat trout is limited.

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Stream Under Gravitte Topics Analysis.

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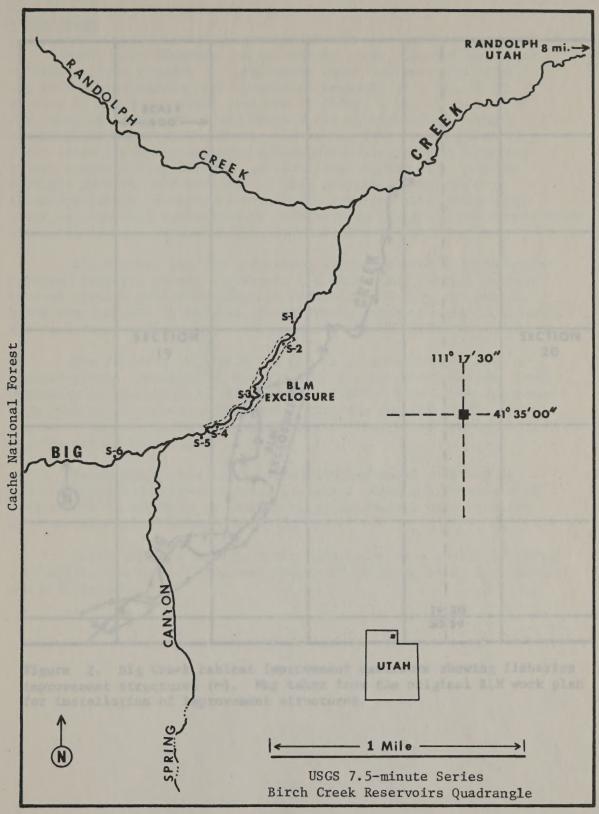


Figure 1. Big Creek study area.

Fronte 1. Big Greek study aven.

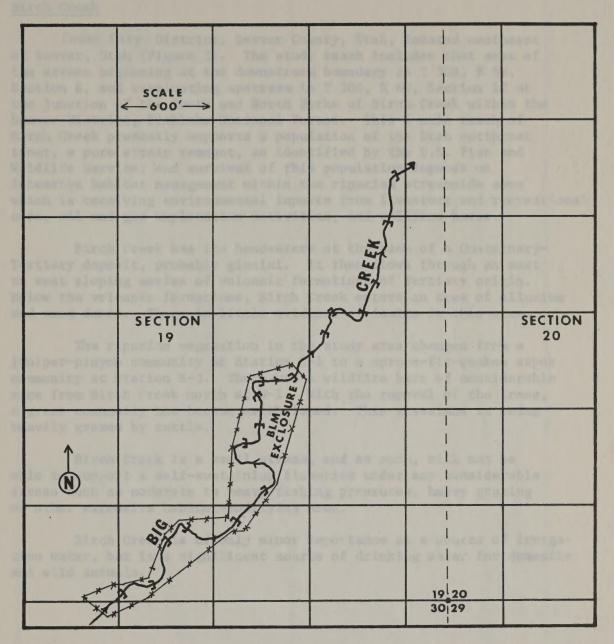


Figure 2. Big Creek habitat improvement exclosure showing fisheries improvement structures (n). Map taken from the original BLM work plan for installation of improvement structures.

Figure 2. Big Greek hibiter twy revenue or intrince the charies listed to a superior listed to a superior plant to the first the categories of the course of

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### Birch Creek

Cedar City District, Beaver County, Utah, located southeast of Beaver, Utah (Figure 3). The study reach includes that area of the stream beginning at the downstream boundary in T 30S, R 6W, Section 6, and terminating upstream in T 30S, R 6W, Section 12 at the junction of the South and North Forks of Birch Creek within the Beaver District, Fishlake National Forest. This 6-mile reach of Birch Creek presently supports a population of the Utah cutthroat trout, a pure strain remnant, as identified by the U.S. Fish and Wildlife Service; and survival of this population depends on intensive habitat management within the riparian streamside zone which is receiving environmental impacts from livestock and recreational uses, oil and gas exploration activities, and wildfire burns.

Birch Creek has its headwaters at the base of a Quaternary-Tertiary deposit, probably glacial. It then flows through an east to west sloping series of volcanic formations of Tertiary origin. Below the volcanic formations, Birch Creek enters an area of alluvium and sand dunes. There is little evidence of faults in this area.

The riparian vegetation in the study area changes from a juniper-pinyon community at Station S-1 to a spruce-fir-quaken aspen community at Station S-3. There was a wildfire burn of considerable size from Birch Creek north at S-1. With the removal of the trees, a grass community has become established. This grassland is being heavily grazed by cattle.

Birch Creek is a small stream, and as such, will not be able to support a self-sustaining fisheries under any considerable stress such as moderate to heavy fishing pressures, heavy grazing or other extensive habitat-modifying uses.

Birch Creek is of only minor importance as a source of irrigation water, but is a significant source of drinking water for domestic and wild animals.

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Carteners, Uses (Figure 3). The oracly reach includes that area of the errans beginning at the demarkant Section 6; and terminating upstream Section 10 7 307, R 507, R 507, the junction of the Seath was North Forks of Sirch Creek within the Sarver District. Fishelska National Forks of Sirch Creek within the Sarver Creek presently supports a population of the U.S. Fish and cutting the creek of the U.S. Fish and the court a para strain remant, as identified by the U.S. Fish and this service; and survival of this population depends on which is receiving convenient upstall the receiving sourcement within the which is received and receivable convenient of the U.S. Fish and which is receiving antique of the U.S. Fish and which is receiving antique of the U.S. Fish and which is received and receivable convenient of the U.S. Etch Index convenients.

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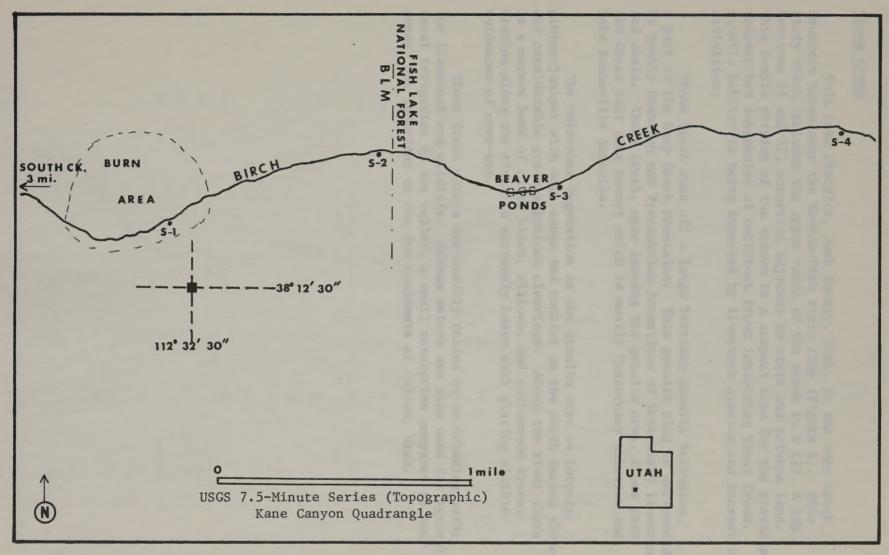


Figure 3. Birch Creek study area.

The state of the s

### Thoms Creek

Salt Lake District, Juab County, Utah, in the Deep Creek Mountain Range near the Nevada-Utah state line (Figure 4). This study reach includes the upper reach of the creek in T 11S, R 18W, Sections 16 and 17, occurring adjacent to state and private land. This 2-mile portion of the stream is a suspect area for the previously undescribed subspecies of cutthroat trout inhabiting Trout Creek. Aquatic habitat is being impacted by livestock grazing and recreational activities.

Thoms Creek runs off a large Tertiary granite intrusion, a part of the Deep Creek Mountains. This granite plug is surrounded by mostly Cambrian and Precambrian formations of intermixed limestone and shale. Thoms Creek, upon leaving the granite area, flows into the Great Salt Lake Desert which is mostly Quaternary alluvium and Lake Bonneville deposits.

The watershed vegetation in the granite area is largely pinyon-juniper with some aspen and conifer on the north facing slopes and considerable grass-sagebrush clearings. Along the river there is a narrow band of river birch, willows, and cottonwood trees. Grazing along the river is extremely heavy with glaring visible evidences of over-use.

Thoms Creek waters are heavily relied on as drinking water for livestock and wildlife. Stream waters are also used for agricultural irrigation in the valley, a small enterprise compared to many areas, but important to the few residents of Callao, Utah.

Thoma Creek

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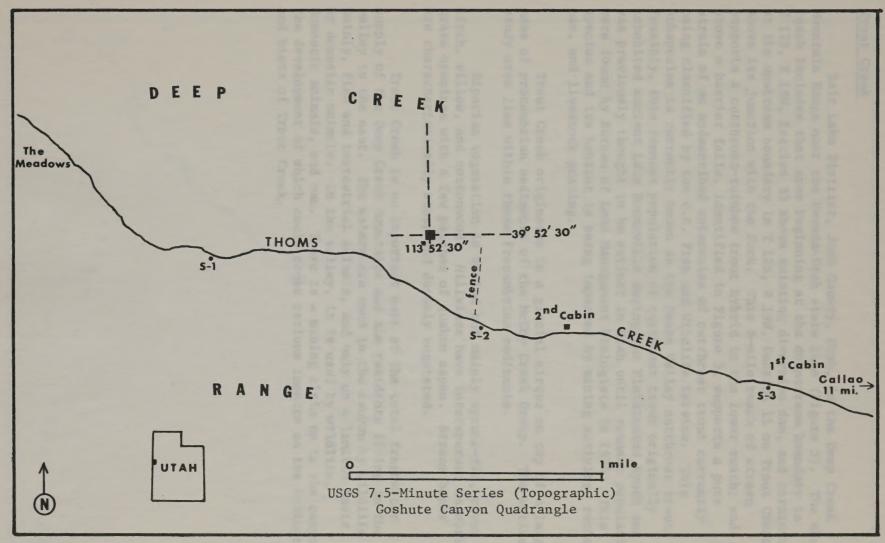


Figure 4. Thoms Creek study area.

### Trout Creek

Salt Lake District, Juab County, Utah, in the Deep Creek Mountain Range near the Nevada-Utah state line (Figure 5). The study reach includes that area beginning at the downstream boundary in T 12S, R 18W, Section 33 above existing diversion dam, and terminating at the upstream boundary in T 12S, R 19W, Section 11 on Trout Creek above its junction with the Fork. This 6-mile reach of stream supports a cutthroat-rainbow trout hybrid in the lower reach; and above a barrier falls, identified in Figure 5, supports a pure strain of an undescribed subspecies of cutthroat trout currently being classified by the U.S. Fish and Wildlife Service. This subspecies is currently known as the Snake Valley cutthroat trout. Possibly, this remnant population of cutthroat trout originally inhabited ancient Lake Bonneville during the Pleistocene Epoch and was previously thought to be extinct in Utah until remnant populations were found by Bureau of Land Management biologists in 1974. This species and its habitat is being impacted by mining activity, recreational use, and livestock grazing.

Trout Creek originates in a glacial cirque on top of a large mass of precambrian sediments of the McCoy Creek Group. The entire study area lies within these Precambrian sediments.

Riparian vegetation is varied but mainly spruce-fir, river birch, willow, and cottonwood. Hillsides have interspersed sagebrushgrass openings with a few patches of quaken aspen. Stream banks are characteristically steep and densely vegetated.

Trout Creek is an important part of the total freshwater supply of the Deep Creek Mountains and the residents living in the valley to the east. The waters are used in the canyon by wildlife mainly, fish and terrestrial animals, and only on a limited basis by domestic animals. In the valley, it is used by wildlife, domestic animals, and man. There is a mining claim up in the canyon, the development of which could cause serious impacts on the habitat and biota of Trout Creek.

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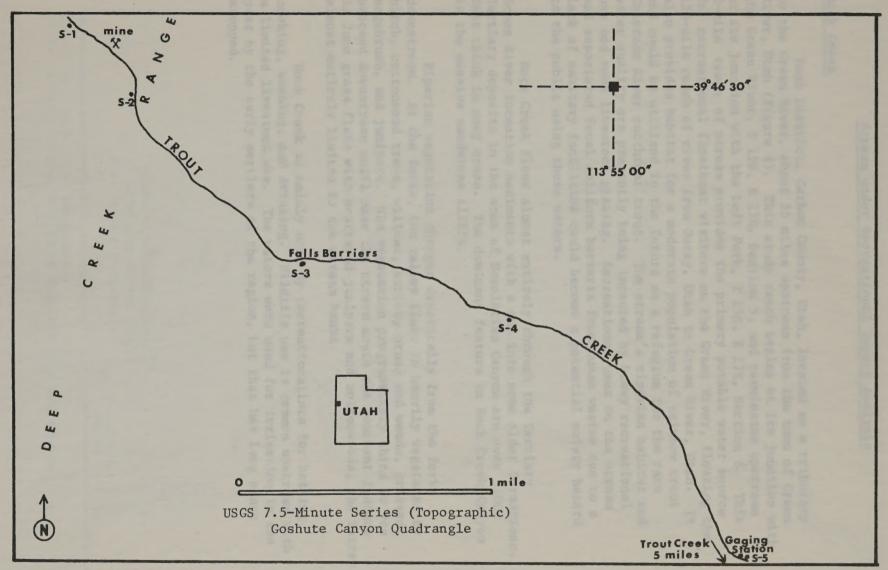


Figure 5. Trout Creek study area.

## Stream under Recreational Impact Analysis

### Rock Creek

Moab District, Carbon County, Utah, located as a tributary to the Green River, about 55 miles upstream from the town of Green River, Utah (Figure 6). This study reach begins at its junction with the Green River, T 15S, R 17E, Section 5, and terminates upstream at its junction with the Left Fork, T 15S, R 17E, Section 6. 2-mile reach of stream provides the primary potable water source for recreational floatboat visitors on the Green River, floating the 128-mile reach of river from Ouray, Utah to Green River, Utah. It also provides habitat for a moderate population of rainbow trout and could be utilized in the future as a refugium for the rare Colorado River cutthroat trout. The stream's riparian habitat and water quality are presently being impacted by heavy recreational use and some livestock grazing. Recreational uses on the stream and associated fecal coliform bacteria from human wastes due to a lack of sanitary facilities could become a potential safety hazard to the public using these waters.

Rock Creek flows almost entirely through the Tertiary Green River formation sediments with a cut into some older formations. Tertiary deposits in the area of Desolation Canyon are over 5,000 feet thick in many areas. The dominant feature in Rock Creek Canyon is the massive sandstone cliffs.

Riparian vegetation changes drastically from the forks downstream. At the forks, the valley floor is heavily vegetated by birch, cottonwood trees, willows, various brush and weeds, grasses, sagebrush, and junipers. The vegetation progressively thins as you proceed downstream until near the stream mouth the dominant feature is June grass flats with scattered junipers and cottonwoods, the latter almost entirely limited to the stream banks.

Rock Creek is mainly used by recreationalists for bathing, cooking, washing, and drinking. Wildlife use is common upstream with a limited livestock use. The waters were used for irrigation in the past by the early settlers of the region, but that has long since stopped.

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Rock Creek flows almost entirely through the Pertiary Green River formation assimable with a tot into some older formations. Tertiary deposits in the area of Desolation Conyon are over 5.000 feet thick in way areas. The dominant fusture is nock treek Capyon is the caseive emodulous illiffs.

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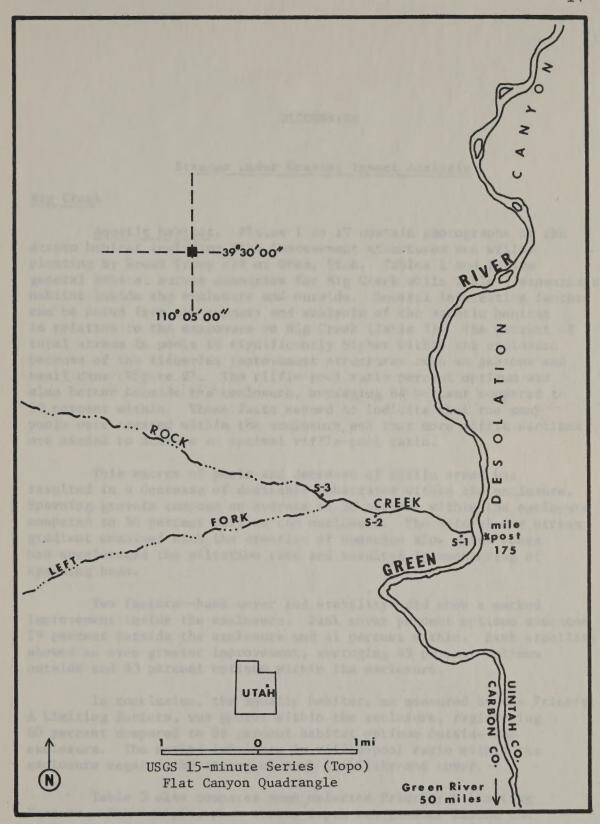
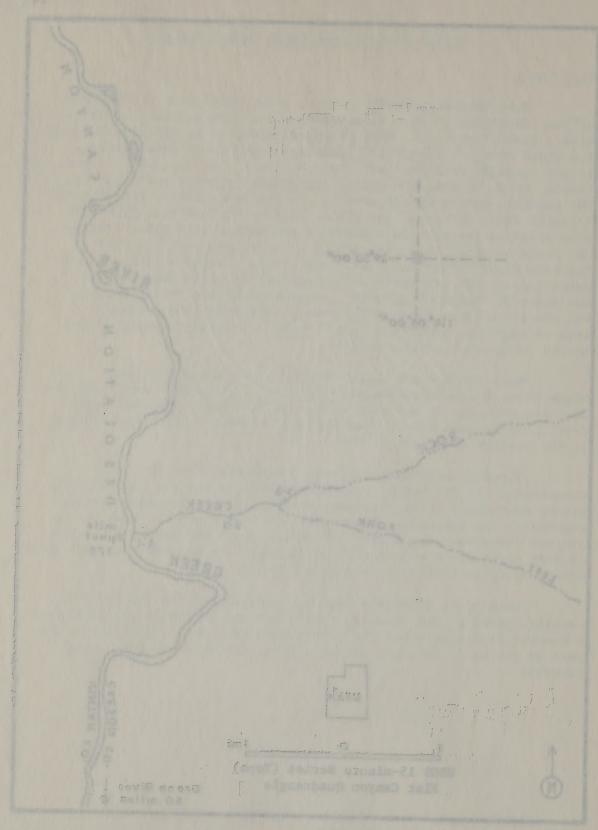


Figure 6. Rock Creek study area. \*River miles from the confluence with the Colorado River.



Pigure 6. Mock Creek study stes.

#### DISCUSSION

### Streams Under Grazing Impact Analysis

### Big Creek

Aquatic habitat. Plates I to IV contain photographs of the stream habitat including fish improvement structures and willow planting by Scout Troop 171 of Orem, Utah. Tables 1 and 2 give general habitat survey summaries for Big Creek while Table 3 summarizes habitat inside the exclosure and outside. Several interesting factors can be noted from the summary and analysis of the aquatic habitat in relation to the exclosure on Big Creek (Table 3). The percent of total stream in pools is significantly higher within the exclosure because of the fisheries improvement structures such as gabions and small dams (Figure 2). The riffle-pool ratio percent optimum was also better outside the exclosure, averaging 84 percent compared to 50 percent within. These facts seemed to indicate that too many pools were created within the exclosure and that more riffle sections are needed to achieve an optimal riffle-pool ratio.

This excess of pools and decrease of riffle areas has resulted in a decrease of desirable substrates within the exclosure. Spawning gravels compose an average of 30 percent within the exclosure compared to 50 percent outside the exclosure. The natural low stream gradient combined with the creation of numerous slow water zones has accelerated the siltation rate and resulted in smothering of spawning beds.

Two factors—bank cover and stability—did show a marked improvement inside the exclosure. Bank cover percent optimum averaged 29 percent outside the exclosure and 41 percent within. Bank stability showed an even greater improvement, averaging 49 percent optimum outside and 83 percent optimum within the exclosure.

In conclusion, the aquatic habitat, as measured by the Priority A Limiting Factors, was poorer within the exclosure, registering 60 percent compared to 66 percent habitat optimum outside the exclosure. The marked imbalance in riffle-pool ratio within the exclosure negated the increased bank stability and cover.

Table 3 also compares some selected Priority B Limiting Factors. For example, mean stream depth was greater inside the exclosure. This was probably due to the more numerous pools. Mean channel width was less inside the exclosure which perhaps indicates increased bank stability. Most other factors compared about the same except for an increase in stream shade within the exclosure.

#### MULESCORE

## Streams Index Grants Impact brolysis

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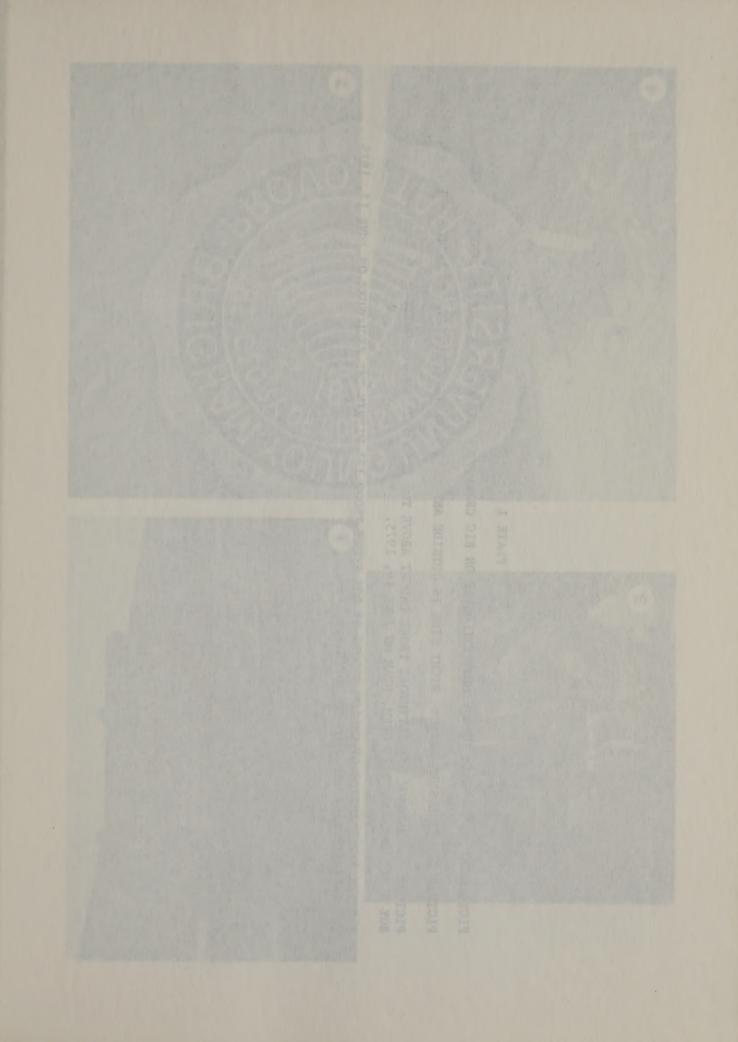
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### PLATE I

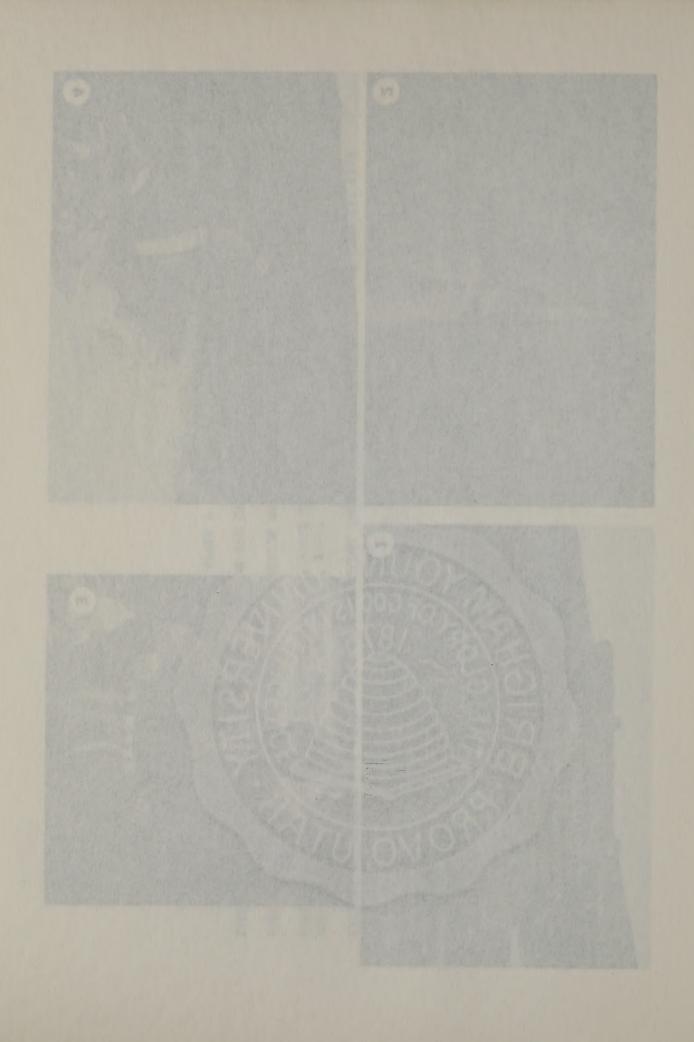
- PICTURE 1. BLM STREAM IMPROVEMENT EXCLOSURE ON BIG CREEK, BYU STREAM SURVEY TEAM, JUNE 17, 1975.
- PICTURE 2. EXCLOSURE FENCE: RIGHT SIDE IS OUTSIDE AND LEFT SIDE IS WITHIN THE EXCLOSURE, JUNE 17, 1975.
- PICTURE 3. RAINBOW AND CUTTHROAT TROUT CAUGHT ABOVE THE EXCLOSURE ON BIG CREEK BY GARY GUMMOW, A BOY SCOUT IN TROOP 171, OREM, UTAH ON JUNE 18, 1975.
- PICTURE 4. PLANTING OF WILLOW SHOOTS BY BOY SCOUT TROOP 171 WITHIN THE EXCLOSURE ON JUNE 17, 1975 TO STABILIZE BANK AND PROVIDE COVER FOR FISH.

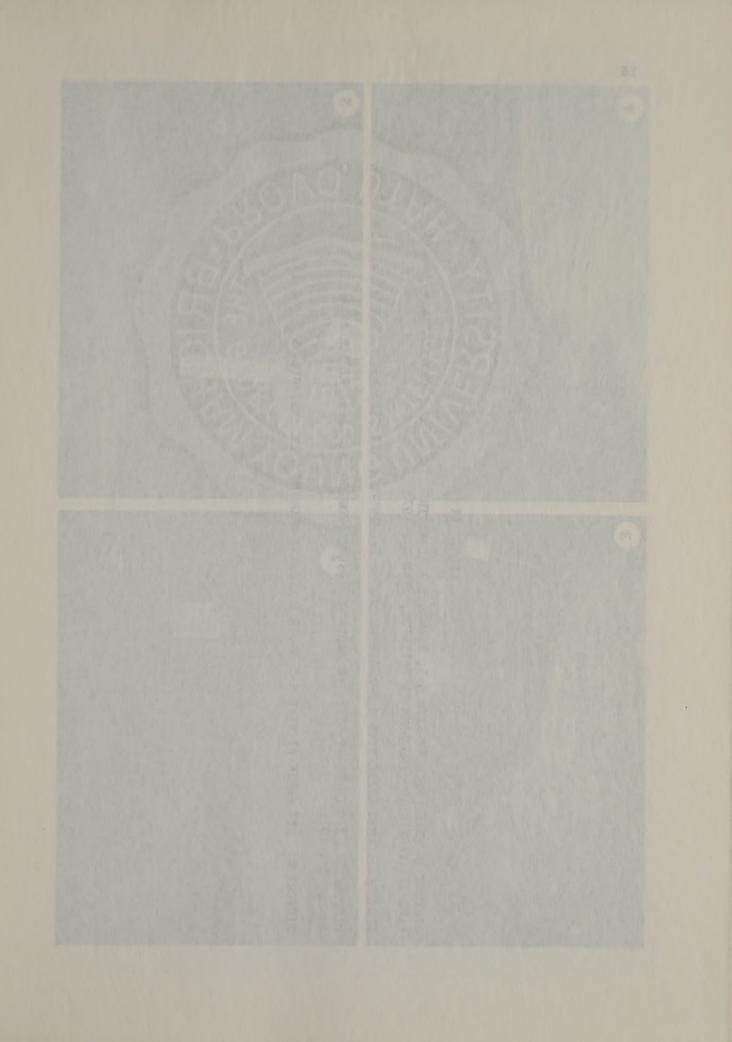






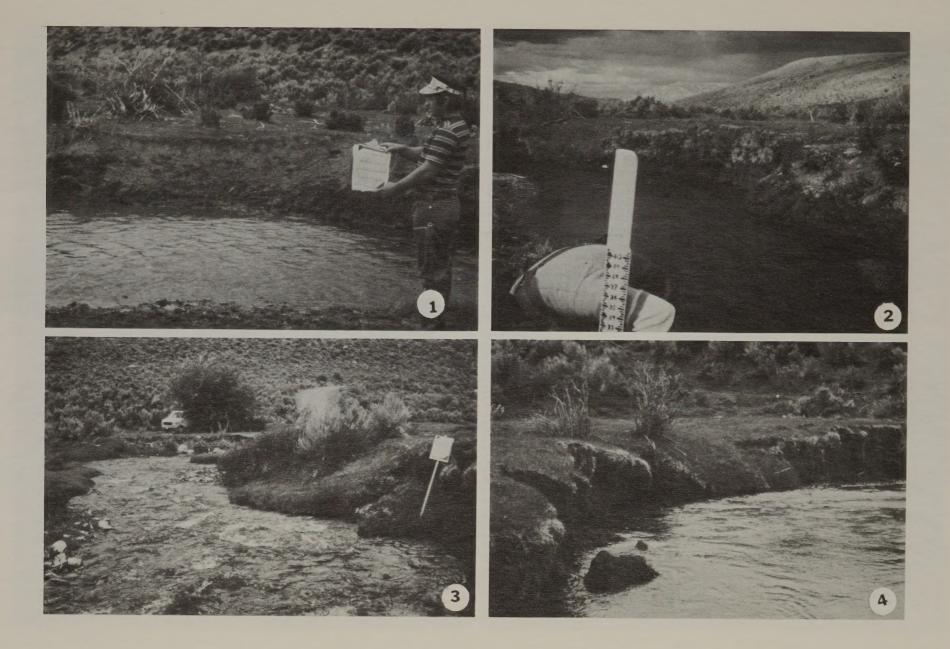


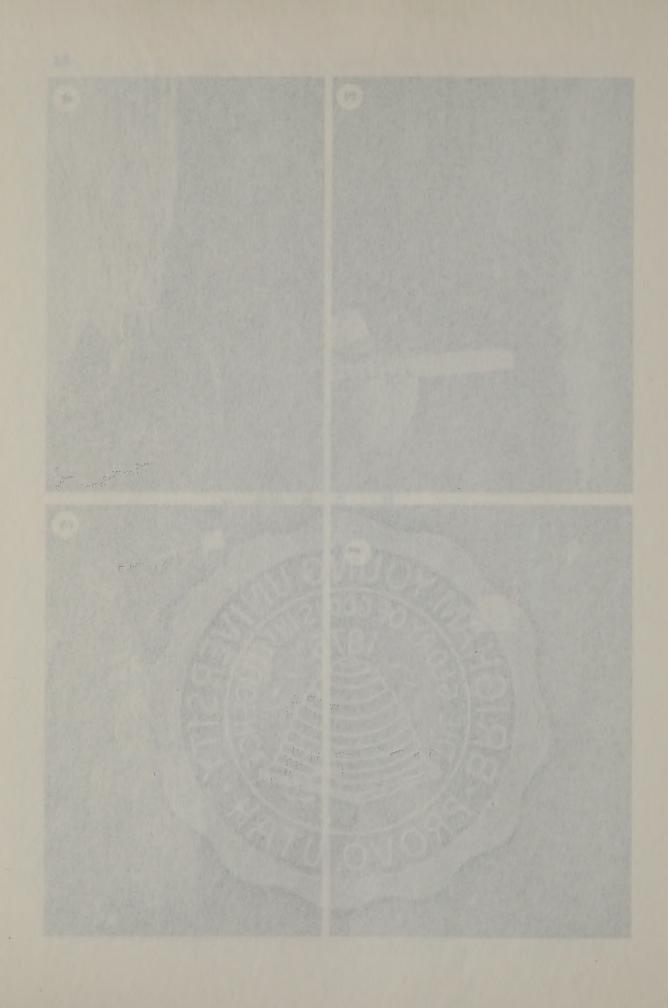




### PLATE II

- PICTURE 1. BIG CREEK AT SITE S-5, TRANSECT 3 ABOVE THE EXCLOSURE. CATTLE TRAIL SHOWING LACK OF RIPARIAN VEGETATION AND BANK INSTABILITY, JUNE 17, 1975.
- PICTURE 2. BIG CREEK SITE S-5 ABOVE EXCLOSURE SHOWING LACK OF STREAMSIDE VEGETATION, AUGUST 21, 1975.
- PICTURE 3. BIG CREEK AT SITE S-6 ABOVE EXCLOSURE SHOWING EXCELLENT RIFFLE AREA AND BANK EROSION, AUGUST 21, 1975.
- PICTURE 4. BIG CREEK AT SITE S-5 ABOVE EXCLOSURE SHOWING BANK INSTABILITY, JUNE 17, 1975.

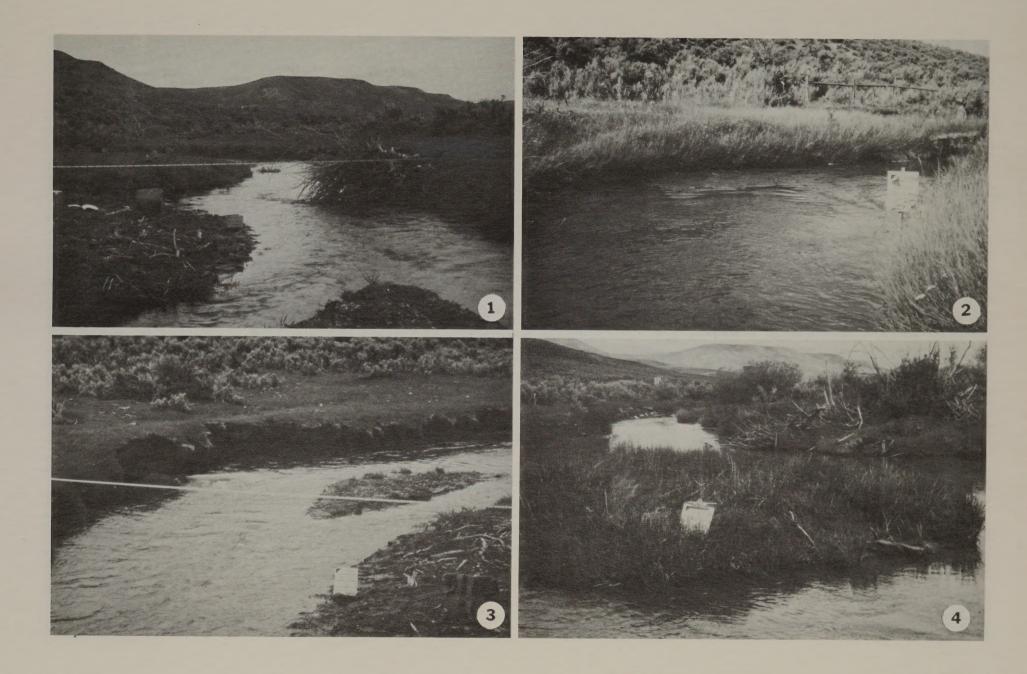


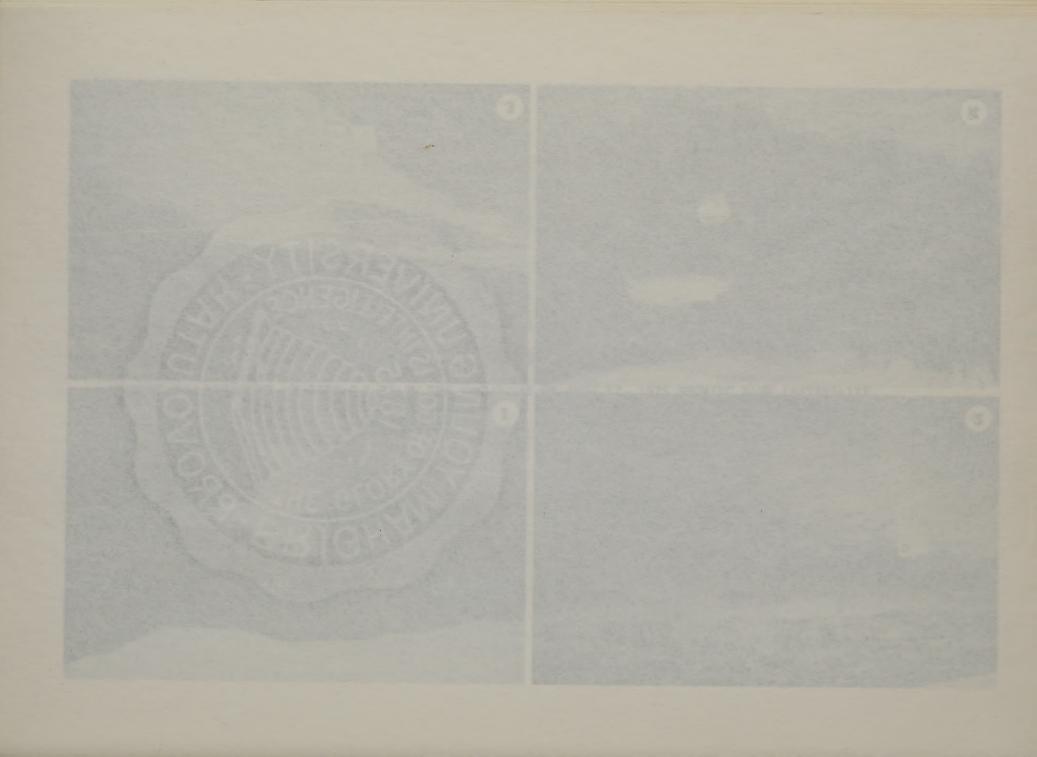


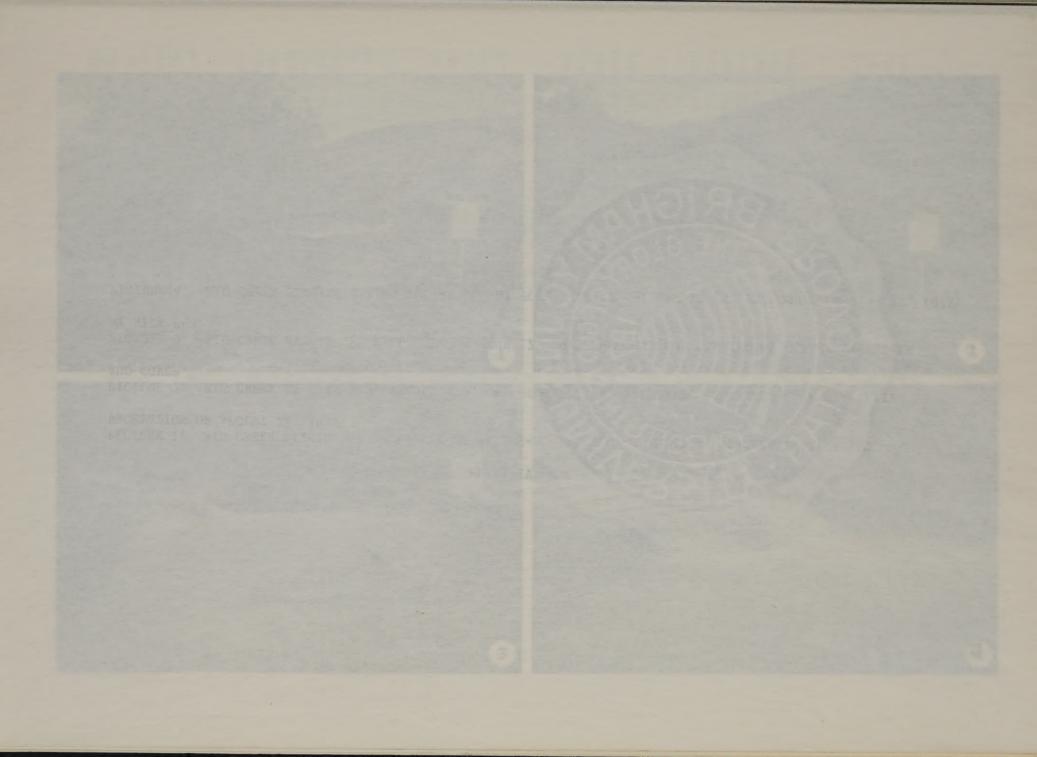


### PLATE III

- PICTURE 1. BIG CREEK AT SITE S-1 BELOW THE EXCLOSURE ON JUNE 17, 1975.
- PICTURE 2. BIG CREEK AT SITE S-4, TRANSECT 3 ON AUGUST 21, 1975.
- PICTURE 3. BIG CREEK AT SITE S-1 BELOW THE EXCLOSURE ON JUNE 17, 1975 SHOWING BANK INSTABILITY AND LACK OF RIPARIAN VEGETATION.
- PICTURE 4. BIG CREEK WITHIN THE EXCLOSURE AT SITE S-2, TRANSECT 3 ON JUNE 17, 1975.

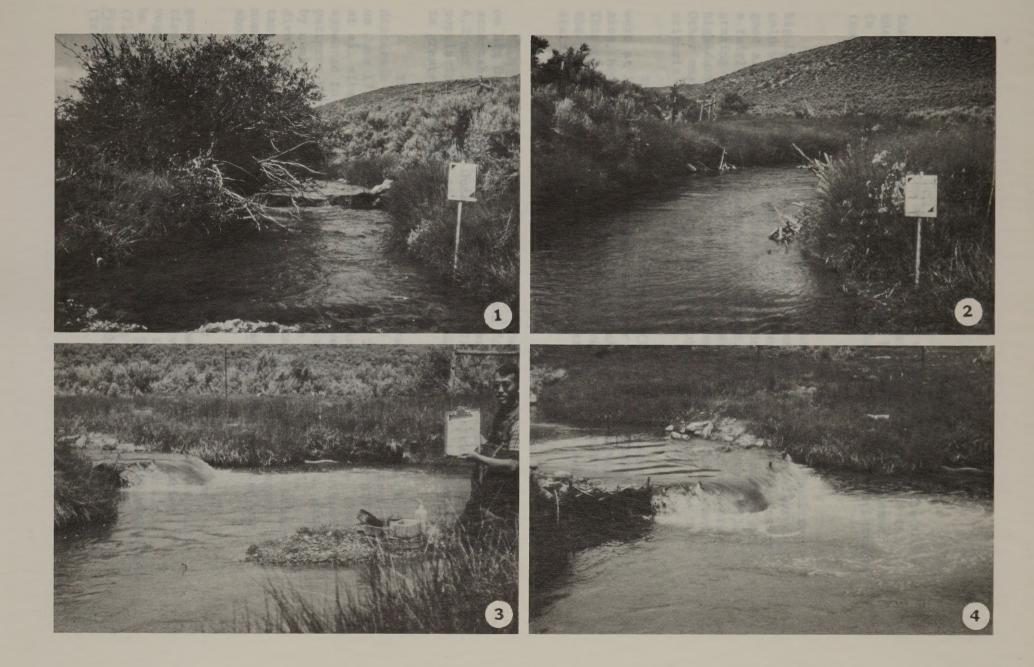


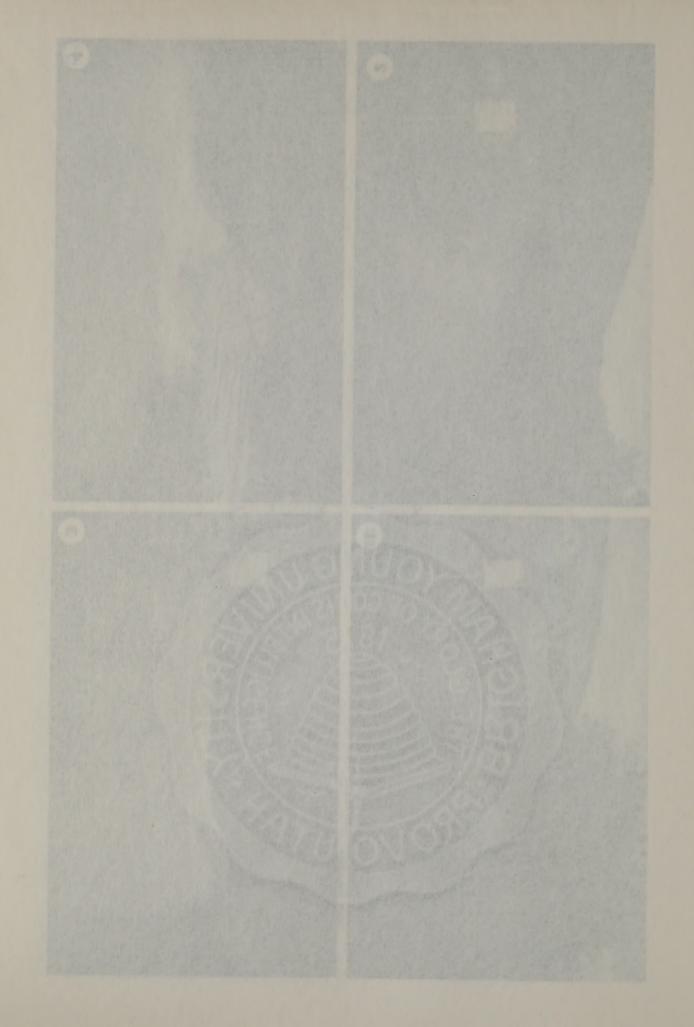




### PLATE IV

- PICTURE 1. BIG CREEK WITHIN THE EXCLOSURE AT SITE S-2, TRANSECT 3 SHOWING INCREASE IN RIPARIAN VEGETATION ON AUGUST 21, 1975.
- PICTURE 2. BIG CREEK AT SITE S-3, TRANSECT 5, ON AUGUST 21, 1975 SHOWING INCREASED BANK STABILITY AND COVER.
- PICTURE 3. BIG CREEK WITHIN THE EXCLOSURE ON JUNE 17, 1975 SHOWING POOL CREATED BY GABION STRUCTURE AT SITE S-3.
- PICTURE 4. BIG CREEK SHOWING GABION AND RESULTANT POOL AT SITE S-2 WITHIN THE EXCLOSURE ON JUNE 17, 1975.





In summary, the riparian habitat was in much better condition inside the exclosure than outside; however, it is questionable if the total fisheries habitat has improved because of the imbalance in the riffle-pool ratio and high percentage of undesirable substrates (mean 35 percent).

Water quality. As observed in Table 4, the water quality in Big Creek is good. It is a moderately hard, bicarbonate buffered cold water mountain stream. Nutrient levels are adequate to ensure good algal productivity. Nitrate and phosphate levels remained at a fairly high level throughout the summer, probably due to cattle grazing in the bottomlands. In natural streams the nutrients are high during spring runoff and then decrease throughout the summer. Other measured water quality standards appear to be within the Utah criteria for Class CC waters.

Total and fecal coliform counts (Table 4) on August 21 were at low levels considering the number of cattle grazing in the area; however, on June 19, bacterial levels were relatively high. This could have resulted from rains and resultant runoff during the preceding two or three days. They were still well below the state standards for Class C waters.

Macroinvertebrate communities. Benthic sampling efficiency on Big Creek (Table 7) was analyzed and found to be well within acceptable limits with the percent standard error of the mean being 4.2 and 14.6 for 17 June and 21 August 1975, respectively. The populations appeared to be more clumped on August 21, thus resulting in greater variation among samples.

The benthic communities of Big Creek were dominated by dipterans (mostly Chironomidae) (Table 8) averaging 81 percent on June 17 and 51 percent on August 21. The low community diversity at all sites on 17 June reflects this chironomid dominance. There appeared to be no differences in macroinvertebrate distributional patterns between the sites outside and within the exclosure, either by numbers or biomass (Table 9 and Figure 7). By August 21, diversity values had increased at all sites, reflecting the simultaneous decrease in dipteran (chironomid) dominance and increase in numbers of ephemeropterans (mayflies). Baetis spp. accounted for about 95 percent of the mayfly dominance.

High, unstable numbers of baetids and chironomids are a good indication of some types of environmental stress such as siltation, and organic enrichment. The relative absence of riparian vegetation and resulting elevated summer temperatures could also be a limiting factor to benthic faunas. There were very few stoneflies (Plecoptera) in the system and those that were there, such as Pteronarcella sp. and Isoperla sp., are the more tolerant forms (Table 9).

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Verest unmility. As abserved in Yolin is the variet quality in all Creek is good. It is a mederately hard, bleerbooks buildred ...

good algal productivity. Mikrate and chosphere Levels named an fairly high level throughout the secure, gradebly due to cantla greates in the bottemlands. In natural strategy the nutricate are high during spring runost and then decrease throughout the number.

Other measured water quality etenderess throughout the number.

Total and feesl coliform counts (Toble 6) on Angest 22 7. ...
were at low levels considering the number of certile costems to the
area; however, on time 15, becautal levels vere relevively high.
This could have resulted from raids and resultant smoots devices
the preceding two or three days. They were still well below the
state standards for Class C waters.

Macrolavertebrate communician Bioshio sampling officiency
on Big Orack (Table 7) West wealt, and idead to be well within
acceptable limits with the percent cruided where of the menn below
4.2 and 16.6 for 17 June and 21 Sugart 1875, respectively. The
populations expected to be dead flumball on Anguer 21. The resulting

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Right was under the sound of the control of the con

Management alternatives. The exclosure has been effective in increasing bank stability and cover; however, too many dam-like fisheries improvement structures were built, resulting in a dominance of pools and a shortage of riffles. Any future improvements above or below the exclosure should limit the number of structures built.

It appears from the condition of the riparian habitat outside the exclosure that access of cattle to the stream needs to be limited to specified watering areas with a buffer zone established along the majority of the stream. A riparian buffer zone should be created along the stream in the more heavily used areas, eliminating livestock use in this zone except for cattle pass-ways or off-stream water deployment. Reseeding plus natural revegetation would greatly stabilize the banks, provide more cover and decrease daily mean water temperatures during the critical summer months.

Stream flows appear adequate at present, but minimum flows should be determined and no sub-minimal flows permitted.

The habitat inside the exclosure is still undergoing considerable change. In order to evaluate the continued effectiveness of the exclosures, this study should be continued, including aerial infra-red photography and vegetative mapping.

Monagement plantatives. The exclosure has been effective in increasing bank stability and cover; however, too many densities fisheries improvement structures were built, resulting in a doutnance of pools and a shortage of riffies. Any future improvements above or below the exclosure about limit the number of structures built.

It appears from the condition of the riparian habitat outside
the exclosure that access of cattle to the ecream meeds to be limited
to specified watering areas with a buffer rose setcolicied along the
majority of the stream in the more beavily used areas, elasticating
livestock use in this sore trace; for cattle pres-ways or of-stream
water deployment. Nowegeled that a stream of the stream
stabilize the benks, provide more cover and decrease daily read mater
tamperatures during the rritical student and decrease daily read mater

Stream flows appear adequate at product, but midlens llows should be determined and no sub-winimal flows permitted.

The hebitet inside the exclosure is crill undergoing consider able change. In order to evaluate the continued effectivement of the exclosures, this erody should be continued, including merial infra-red photography and regarditys mapping.

Table 1. Stream habitat survey summary and analysis for Big Creek on 21 August 1975.

1.	State, County	2. District		3. Resource AreaP.L	ī.
	Utah, Rich	Salt Lake		WasatchRandolp	b
4.	Drainage	5. Stream Unit	t	6. Location	711
	Annual States in		100	T P Co	ect.
7.	Bear River Investigators	Big Creek		8. Date	19
	Winget and Reichert			21 August 1975	
-	General Data			Priority A Limiting Factors	
9.	Total length of stream (mi	<u>≃20</u>	25.	Percent of total stream width in pools	59%
.0.	Total length of stream		26.	Pool-riffle ratio, % optimum	82
	surveyed (mi.) a. BLM	1.5	27.	Pool quality, % optimum	72
	b. Public	1.3		And American Street	16
	c. Private		28.	Percent of stream bottom with desirable materials	74
1.	Total No. sample stations:		29.	Percent spawning gravels	45
	a. BLM	6	30.	Bank cover, % optimum	32
	b. Public		76.4	ment on such a phonon	
	c. Private		31.	Bank stability, % optimum	76
2.	Total of all stream width		32.	Percent of habitat optimum	67
	measurements (ft.)	424			
				Priority B Limiting Factors	
3.	Total channel width (ft.)	680	33.	Average depth of stream (ft.)	0.85
4.	Total widthall pools (ft.	251	34.	Average width of stream (ft.)	14
_	m			WALLES AND DESCRIPTION OF REAL PROPERTY.	
5.	Total width of all pools classed 1, 2, and 3 (ft.)	220	35.	Average width of channel (ft.)	22.7
	classed 1, 2, and 3 (It.)	220	36.	Percent of bottom with	
6.	Total footage of desirable			clinging vegetation (ft.)	trace
	bottom materials (ft.)	314	37.	Percent of bottom with	
_		. 101		rooted vegetation (ft.)	≃1%
7.	Total spawning gravels (ft.	191	38.	Percent stream shade	≃2%
8.	Sum of cover ratings	76	39.	Average stream gradient (%)	1%
		100	40.	Average stream velocity (f/s)	1.6
9.	Sum of stability ratings	182	41.	Stream discharge (cfs)	12.9
0.	Elevation: (MSL)		100	The same of the sa	12.7
	a. Lowest	6,594	42.	Average water temperature:	14°C
	b. Highest	6,610		(°F or °C)	14 0
			43.	Average Air Temperature	
1.	Multiple use zones water			(°F or °C)	21.3°C
	recreat		44.	Turbidity description (clear)	7 JTU
	agricui		45.	Access (mi.):	
2.	Number of camera points		13.	a. Remote	
		Name of the Assessment		b. Low standard trails	
3.	Total cost			c. Improved trails	
	a. Planning			d. Low standard roads	10
	b. Salaries			e. Improved roads (graded)	
	<ul><li>c. Equipment</li><li>d. Analysis of data</li></ul>		46.	Water quality analysis:	
	a. maryors or data			a. Hach kit (pH, DO, CO <sub>2</sub> , T	
4.	Cost per station	1 13 1		b. Chemical (BYU)	X
	The same of the sa	-		c. Coli (BYU)	X

Table 1. Stream hubitst survey cummary and analysis for Mrg Creek

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			noway.
			an and a second second
			B. B. B. Bridge
			9.34

Table 2. Stream habitat survey summary and analysis for Big Creek for June 17, 1975.

1.	State, County	2.	District			3. Resource AreaP.U.	
	Utah, Rich		Salt Lake			WasatchRandolph	
4.	Drainage Bear River	5.	Stream Unit Big Creek	paye	1975	6. Location T. 10N R. 6E Sect.	
7.	Investigators Winget and Reichert					8. Date June 17, 1975	
	General Data		Uuqalde		Prior	ity A Limiting Factors	de
9.	Total length of stream (mi	.)	20	25.		of total stream width	
10.	Total length of stream				in pools		61%
	surveyed (mi.)			26.		ffle ratio, % optimum	78
	a. BLM b. Public		1.5	27.	Pool qua	ality, % optimum	63.
	c. Private		sta ere	28.		of stream bottom sirable materials	63
11.	Total No. sample stations:			29.	Percent	spawning gravels	33
	a. BLM 5;	phys	. 6 benthos	30.	Bank cov	ver, % optimum	39
	c. Private		-	31.	Bank sta	ability, % optimum	56
12.	Total of all stream width measurements (ft.)		63%	32.	Percent	of habitat optimum	60
	measurements (It.)		415		Priori	ty B Limiting Factors	
13.	Total channel width (ft.)		630	33.		depth of stream (ft.)	0.9
14.	Total widthall pools (ft.	)	252	34.	600	width of stream (ft.)	16
15.	Total width of all pools			35.		width of channel (ft.)	24.2
	classed 1, 2, and 3 (ft.)		203	36.	Percent	of bottom with	24.2
16.	Total footage of desirable bottom materials (ft.)		247_	37.	Percent	of bottom with	
17.	Total spawning gravels (ft.	)	135	38.		regetation (ft.) stream shade	≃1%
18.	Com of source matrices					_	7
10.	Sum of cover ratings			39.		stream gradient (%)	≃2
19.	Sum of stability ratings		117_	40.	Average	stream velocity (f/s)	1.5
20.	Elevation: (MSL)			41.	Stream d	ischarge (cfs)	13.3
	a. Lowest b. Highest		6,594	42.	Average (°F or °	water temperature: C)	10°C
21.	Multiple use zones water			43.	Average (°F or °	Air Temperature C)	13.6°C
	recreat agricul			44.	Turbidit	y description (clear)	JTU
22.	Number of camera points			45.	Access (	mi.): mote	
23.	Total cost					w standard trails	
Turo	a. Planning					w standard roads	
	<ul><li>b. Salaries</li><li>c. Equipment</li></ul>				e. Im	proved roads (graded	10
	d. Analysis of data			46.	Water qu	ality analysis:	
24.	Cost per station				b. Ch	emical (BYU)	<u>x</u> .
			101.2		c. Co	li (USGS) _	X

Table 2. Street belief curvey summary and analysis for Big Greek for June 17, 1975.

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	ed T	According to the account (5%)	
		C.28) Lambins to debite desired	
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Table 3. Summary and analysis of riparian habitat outside and inside the exclosure on Big Creek on 17 June 1975 and 21 August 1975.

	17 Jun	e 1975	21 August 1975		
Priority A Limiting Factors			Outside Exclosure		
Percent of total stream width in pools	49%	69%	50%	72%	
Pool-riffle ratio, % optimum	98%	62%	100%	56%	
Pool quality, % optimum	70%	57%	97%	43%	
Percent of stream bottom with desirable materials	63%	55%	76%	75%	
Percent spawning gravels	47%	20%	53%	39%	
Bank cover, % optimum	25%	50%	32%	32%	
Bank stability, % optimum	35%	72%	63%	93%	
Percent of habitat optimum	58%	59%	74%	60%	
Priority B Limiting Factors					
Mean stream depth (ft)	0.62'	1.1'	0.78'	0.92'	
Mean stream width (ft)	17.7'	14.6'	13.5'	14.1'	
Mean channel width (ft)	28.7'	22.9'	23.4'	21.9'	
Percent of bottom with clinging vegetation	0	0	0	<1%	
Percent of bottom with rooted vegetation	0	0	0	≃1%	
Percent stream shade	4%	11%	3%	8%	
Mean stream gradient	≃1%	≃1%	1.2%	1.11%	
Mean stream velocity (f/s)	1.48	1.4	1.73	1.46	

Table 3. Summary and sunlysis of riperion habites outside and inuide the exclosure on SIE Creek on 17 June 1975 and 21 August 1975.

		elizant arranglasi	et income	
polation i zavio dana				
mank orability, R opilizing	. 75.7.4			WILL .
Percent of Sabitat opelous	. 282			203
Mean stream depth (ft)				
				₹*±

Table 4. Water quality analysis of Big Creek.

		. 1	7 June 197	5	21	August 19	75
Analysis* by	Test	S-1	s-3	S-5	s-1	s-3	S-6
	Time	0900	1220	1540	0830	1100	1330
1	Alkalinity, total as CaCO <sub>3</sub> , mg/l Bicarbonate as HCO <sub>3</sub> , mg/l	206 208	202 226	200 224	218 251	208 239	196 233
1 1 1	Boron as B, mg/l Calcium as Ca, mg/l	82 14	58	60	63	58 7	55
1, 3	Carbonate as CO <sub>3</sub> , mg/1 Chloride as C1, mg/1 Conductivity, µmhos/cm (25° C)	7 367	7 367	8 380	7 285 230	6 320 221	4 310 208
	Hardness as CaCO <sub>3</sub> , mg/1 Hydroxide as OH, mg/1 Magnesium as Mg, mg/1	292 <0.1 21	238 <0.1 22	195 <0.1 11	<0.1 17	<0.1 18	<0.1 17
3 L	pH Potassium as K, mg/l	8.2 0.7 6.3	8.2 0.6 5.8	8.2 0.6 5.8	8.1 0.7 5	8.1 0.7 5	8.1 0.7 4.8
	Sodium as Na, mg/1 Sulfate as SO <sub>4</sub> , mg/1 Total Dissolved Solids	8 225	7 232	7 225	6	6	5
3	Turbidity, JTU's Dissolved Oxygen as O <sub>2</sub> , mg/1	9	9	9	9	5	5 9
	Nitrate as N, mg/l Phosphate (Total) as P, mg/l Phosphate (ortho) as P, mg/l	0.33 0.025 0.025	0.021	0.32 0.004 <0.001	0.24 0.013 0.013	0.33 0.026 0.026	0.29 0.01 0.01
3	Air Temperature, °C Water Temperature, °C	8 7	14 10	20 14	16 9	25 12	22 15
5, 1 5, 1	Total Coliform, MPN/100 ml Fecal Coliform, MPN/100 ml	930 930	930 930	930 430	43 23	75 23	23 23

<sup>\*1.</sup> BYU Environmental Analysis Laboratories
2. USGS
3. Field determinations
4. Bionics
5. Utah Department of Health and Welfare

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19474 4" Avres durilled analyshu ng hys camp-

Table 5. Big Creek water temperature data--daily minimum and maximum temperatures (°C) for June 18 to July 25, 1975.

Date	Min	Max	Date	Min	Max
June 18	0	9.5	July 7	10.5	19.0
19	5.0	8.5	8	10.5	20.0
20	3.0	9.0	9	11.0	18.0
21	6.0	12.0	10	10.5	19.0
22	5.5	18.5	11	10.5	16.0
23	6.5	14.0	12	10.0	14.0
24	6.5	15.0	13	9.5	19.5
25	8.0	11.5	14	10.5	18.5
26	4.5	15.0	15	11.0	19.0
27	5.5	15.5	16	10.5	14.0
28	6.5	16.0	17	8.5	16.0
29	6.5	17.0	18	10.0	19.0
30	6.5	17.0	19	10.0	19.0
July 1	7.0	17.5	20	10.5	17.0
2	8.5	18.5	21	9.5	18.5
3	10.0	12.5	22	10.5	19.0
4	9.0	19.5	23	10.0	18.0
5	10.5	18.0	24	9.5	18.0
. 6	9.5	19.0	25	10.0	18.5
15-day mean	11.	8	15-day mean	14	.0

Table 5. Hig Greek water temperature data-daily minimum and maximum temperatures (°C) for June 18 to July 25, 1975.

			15.0	
	0.01			
	0.01			
1.54			17.5	
28.				
SEA.			$\frac{1}{e^{f}} \int_{0}^{f} e^{f} df$	
.ai		Acceptance of the second		
6.1				

Table 6. Big Creek water temperature data--daily minimum and maximum temperatures (°C) for August 6 to September 11, 1975.

Date	Min	Max	Date Min	Max
Aug. 6	10.0	18.5	Aug. 25 5.0	14.0
7	10.5	16.5	26 6.0	15.5
8	7.5	16.5	27 8.5	13.5
9	7.5	17.0	28 7.0	14.5
10	9.5	17.0	29 6.5	14.5
11	9.5	15.5	30 6.0	15.0
12	9.5	14.5	31 7.5	15.0
13	9.0	13.0	Sep. 1 7.0	13.5
14	8.5	14.0	2 5.5	14.0
15	9.0	16.0	3 5.0	14.0
16	7.5	15.5	4 6.0	14.0
. 17	8.5	16.0	5 5.5	14.5
18	8.5	16.0	6 6.0	14.5
19	7.0	14.0	7 5.0	14.0
20	8.0	12.0	8 6.0	14.5
21	7.5	15.5	9 6.0	13.5
22	8.5	15.0	10 10.0	11.0
23	8.0	14.5	11 8.0	11.5
24	7.5	14.0		
15-day mean	11.	6	15-day mean	10.3

Table 6. Elg Crock water temperature deta-dally minimum and maximum temperatures ("C) for August 6 to Suptember 11, 1975;

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E-41		The second	CHE WALL LED TO THE	E.C.	
	O.C			· · ·	
Elevania.	2.6				
1.61					
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i fil					
·6%					
.65				7.0	
42					
2					

Table 7. Statistics for stepwise pooled samples for Big Creek Site S-2 on 17 June 1975 and 21 August 1975.

Step*	Total No. of Taxa	Mean No/ft <sup>2</sup>	80% Confidence Limits LL	80% Confidence Limits UL	Standard Deviation	Percent SE of Mean	Coefficient of Variation	IΨ	н
17 June 1975									
1 2 3 4 5	23 25 25 28 29	undefined 4,624.0 4,756.3 4,987.0 5,063.6	undefined 4,313.1 4,483.6 4,573.7 4,741.8	undefined 4,934.9 5,029.1 5,400.3 5,385.4	undefined 142.8 250.5 504.6 469.4	undefined 2.2 3.0 5.1 4.2	undefined 3.1 5.3 10.1 9.3	1.93 1.74 1.82 1.98 1.98	1.91 1.72 1.80 1.96
21 August 1975									
1 2 3 4	22 28 28 28	undefined 3,800.0 4,056.3 4,154.2	undefined -503.0 2,459.2 3,160.4	undefined 8,103.0 5,653.5 5,148.1	undefined 1,977.1 1,466.8 1,213.6	undefined 36.8 20.9 14.6	undefined 52.0 36.2 29.2	2.26 2.31 2.63 2.57	2.24 2.29 2.60 2.54

<sup>\*</sup>Step 1 consists of only one sample; Step 2 is the results from 2 pooled samples; Step 3 is the results from 3 pooled samples, etc.

29.2 38.2 38.2 38.2		Constitution of Variations of the Augustian Au
10.9 10.9 10.9		
100.000 P		Standard Deviseico
Madda 5 av	E-100-1-1	Candidance Lantes
3,150.4 2,455.2 -303.0	THE PARTY OF THE P	Canfidance Limits
6.000.0 0.000.0 0.000.0		

Table 8. Summary of macroinvertebrate community analysis for Big Creek on 17 June 1975 and 21 August 1975.

								tes		
		n <sup>2</sup>								
	ža.	Number/m <sup>2</sup>	ra					Invertebra		
	Taxa	mpe	Ephemeropter	ra	Trichoptera	ra		ver		
	of	N	ero	Plecoptera	opt	ote	g	In		
		I K	nem	[00]	chc	eol	teı	er		
0 11 011	Number	Total	Epl	P16	Iri	Coleoptera	Diptera	Other		
Sampling Site	Nu	To	89	8	8%	8%	8%	8%	। ਹ	H
0.1	31, 10 - 10									
S-1 17 June 1975	26	48,850	2	1, 3	2		0.0	10	1	
21 August 1975	27	39,683	3 19	1 2	2 13	2 5	80 45	12 16	1.52 2.95	1.50 2.93
S-2	deline in	33,003		22.	13		43	10	2.93	2.93
17 June 1975	30	54,521	3	1	2	5	68	22	1.98	1.96
21 August 1975	28	44,708	9	1	4	4	50	31	2.57	2.54
S-3 17 June 1975	27	38,628	2	0.5	1	1	00.	,	0.01	0.70
21 August 1975	29	41,405	8	1	13	1 2	92	4 16	0.81 2.43	0.79 2.41
S-4	ANTESTICATION	12,103		- 1	13	2	00	10	2.43	2.41
17 June 1975	31	40,415	4	1	1	2	87	5	1.17	1.15
21 August 1975 S-5	31	28,406	14	2	11	5	54	15	2.99	2.95
17 June 1975	28	21,412	2	1	1	1	01		1 01	0.07
21 August 1975	28	25,189	3 12	1 4	1 16	1 3	91 53	3 12	1.01 2.67	0.97 2.63
S-6	and the same of	,			10		23	12	2.07	2.03
17 June 1975	30	46,548	3	1	2	5	69	21	1.84	1.82
21 August 1975	29	50,830	13	1	12	3	41	30	2.69	2.67

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	00			70 OF			Tutal Z Namber/n2

Table 9. Number per meter square of macroinvertebrate taxa collected from Big Creek.

			17 Jun	e 1975					21 Augu	st 1975		
Taxa	S-1	S-2	S-3	S-4	S-5	S-6	S-1	S-2	S-3	S-4	S-5	S-6
Phylum Aschelminthes						,	-		-			
Class Nematoda	603	979	118	97	108	764	54	108	75	355	301	1,506
Phylum Mollusca												
Class Pelecypoda	11	11	0	0	11	0	11	43	86	65	43	0
Class Gastropoda	0	0	0	0	0	0	0	43	129	161	108	22
Phylum Annelida												
Class Oligochaeta	4,035	8,812	947	882	215	7,693	5,036	5.552	12,514	3,314	2,529	13,525
Phylum Arthropoda		-							,	-,	-,	
Class Arachnida												
Order Acarina												
Suborder Hydracarina	1,851	3,314	484	1,324	409	2,055	1,420	1,205	1,410	872	495	1,991
Class Crustacea												-,
Order Ostracoda	43	22	0	11	0	22	32	. 11	97	97	215	6.
Order Copepoda	0	118	22	22	22	65	11	0	11	0	0	(
Order Amphipoda	0	0	0	0	0	. 0	0	. 0	11	0	0	(
Order Decapoda	0	11	0	0	0	0	11	11	11	0	11	1
Class Insecta					- 5		77		-	10 1		
Order Collembola	11	0	0	0	0	0	0	0	0	0	0	
Family Poduridae	0	22	0	0	0	0	0	0	0	0	0	
Podura aquatica	0	0	0	0	11	0	0	0	0	0	0	
Family Sminthuridae	0	22	0	0	0	0	0	0	0	0	0	
Order Ephemeroptera					150	12 "	1970 4	711	155 84			
Family Siphlonuridae												
Ameletus sp.	0	11	0	11	11	0	0	0	11	0	0	
Family Baetidae						0			11	U	v	,
Baetis spp.	118	97	86	75	54	129	3,669	1,722	2,153	1,980	1,786	5,595
Family Heptageniidae				,,	34		3,007	1,722	2,133	1,500	1,700	3,373
Heptagenia sp.	0	0	0	0	0	0	32	34	54	- 11	43	
Cinygmula spp.	75	43	11	11	0	11	0	0	0	0	0	
Epeorus sp.	0	11	0	0	0	0	0	0	0	0	0	11
Other Heptageniidae	22	0	0	32	32	65	0	0	. 0	0	0	17
Family Leptophlebiidae			0	32	32	0.5			0	U	U	1.1
Paraleptophlebia sp.	86	194	65	75	11	290	344	204	484	129	151	172
Family Ephemerellidae	- 00	134	0,5	, ,	- 11	230	344	204	404	123	131	1/4
Ephemerella sp.	377	613	215	570	129	301	538	430	495	839	140	140
Ephemerella inermis	581	140	183	248	301	183	54	161	140	194	452	64
Ephemerella grandis	398	258	161	581	139	301	3.045	645	775	667	441	678
Ephemerella margarita	0	0	0	0	0	0	11	043	65	0	0	0/0
Ephemerella tibialis	0	0	0	0	0	11	0	22				11
Family Tricorythidae	0	U	U	0	0	11	0	22	0	11	11	11
Tricorythodes sp.	0	0	0	0	0	0	0	22	0	11	0	
Other Ephemeroptera	0	32	22	11	22	22	0	0		11	-	
Order Plecoptera	0	34	22	11	22	22	0	0	0	11	0	(
Family Nemouridae	0	11	0	0	11	0	0	0	0	0	0	0
Family Pteronarcidae	0	11	U	U	11	U	0	U	0	0	0	
Pteronarcella sp.	420	280	129	238	86	226	226	75	108	172	387	172
rteronarcerra sp.	420	200	149	230	00	220	220	/3	108	1/2	367	1/2

						Confidence of the Confidence o
						The state of the
						na ida
						ACTUAL COMME

			17 Jun	e 1975					21 Augu	st 1975		
Taxa	S-1	S-2	S-3	S-4	S-5	S-6	S-1	S-2	S-3	S-4	S-5	S-6
Family Perlodidae	- 12 12											
Skwala parallela	0	0	0	0	0	0	22	11	32	11	75	32
Isoperla fulva	0	A	0	0	A	0	0	0	0	0	0	0
Isoperla patricia	0	0	ő	ő	0	0	ő	11		o	ő	A
Isoperla sp.	43	43	11	22	11	32	334	355	377	517	463	312
Family Chloroperlidae	0	11	11	11	11	32	54	0	0	0	54	22
Other Plecoptera	22	32	22	43	32	11	0	0	33	0	11	0
Order Trichoptera												
Family Rhyacophilidae						3 35 3						
Rhyacophila spp.	22	86	11	0	11	236	0	54	43	0	0	161
Family Glossosomatidae											-	
Agapetus sp. Family Hydropsychidae	0	0	0	0	0	11	0	0	. 0	0	11	0
Hydropsyche spp.	248	818	86	280	43	108	1.011	484	861	11	54	32
Arctopsyche spp.	11	11	0	11	0	11	75	22	11	226	65	301
Other Hydropsychidae	0	0	0	0	0	0	215	0	0	172	0	75
Family Hydroptilidae	0	0	0	0	0	0	0	0	0	0	0	65
Family Limnephilidae	32	32	0	11	0	32	11	32	11	151	11	0
Limnephilus sp. Ecclisomyia sp.	3.	32				32	- 11	32		131	11	0
Family Lepidostomatidae	11	0	0	0	0	0	0	0	0	0	0	0
Family Brachycentridae	215		22	75	100				200			
Brachycentrus sp.	215	11	22	75	108	11	3,938	4,713	753	2,529	3,831	5,391
Micrasema sp.	0	0	0	0	0	0	0	0	0	11	0	0
Other Trichoptera	387	183	204	11	154	43	11	0	0	0	0	0
Order Coleoptera	775	2 406	258	7/.2	212	2 22/	1 761	705	1 070	3 202	710	1 /20
Family Elmidae Family Dryopidae	775	2,486	238	742	312	2,334	1,764	785	1,878	1,302	710	1,420
	0	0	11	0	0	0	0	0	0	0	0	0
Dryops sp.	0	0	0	0	. 0		22		-			0
Family Dytiscidae	0					0		32	86	11	64	. 0
Family Gyrinidae		0	0	11	0	0	0	0	0	0		
Family Curculionidae	0	0	0	0	0	0	0	0	11	11	. 0	0
Family Haliplidae	0	0	0	0	0	0	0	0	0	11	0	0
Other Coleoptera	0	0	U	0	0	0	0	11	0	0	. 0	U
Order Diptera												
Family Tipulidae	118	742	11	.70	22	398	400	601	1 006	312	. 22	796
Antocha monticola			0	75			409	581	1,926		. 22	11
Dicranota sp.	0	11 269		0	0	32	0	506		0		409
Hexatoma sp.	409	269	654	495	441	172	452	0	591	1,636	721 11	409
Holorusia grandis	-	_	11	11	11	11	-	-			0	0
Other Tipulidae	0	11	22	11	0	0	11	22	11	11		
Family Psychodidae	0	0	0	0	11	0	0	0	0	0	0	0
Family Simuliidae	796	1,410	118	0	0	0	238	882	172	721	204	0
Simulium sp.	0	0	0	301	108	118	0	0	0	0	0	807
Family Chironomidae Family Ceratopogonidae	37,682	34,346	34,830	34,195	18,776	30,677	16,376	22,671	19,616	12,471	12,320	18,367
Family Stratiomyidae						2 7 27						
Euparyphus sp.	0	0	0	11	0	0	0	11	0	0	0	11
Family Tabanidae	0	0	0	0	0	0	0	0	11	0	118	226
Family Empididae	108	204	11	32	32	634	366	129	151	54 32	118	226
Other Diptera	11	0	0	0	. 11	0	0	0	0	32	11	44

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TOTAL BY COMPTON

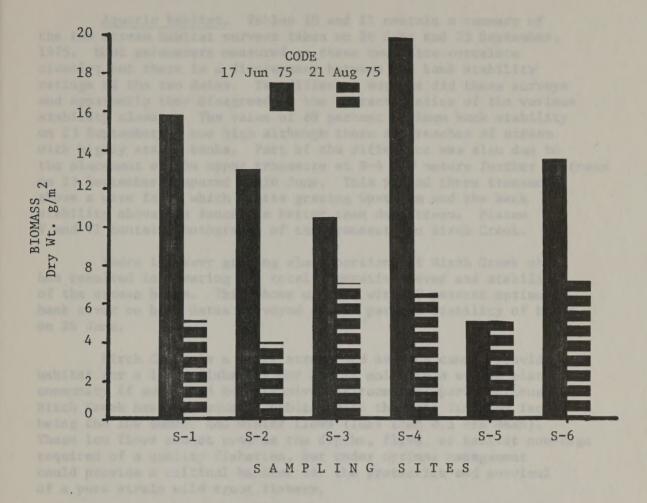


Figure 7. Comparison of macroinvertebrate standing crop (biomass) at six sites on Big Creek on 17 June 1975 and 21 August 1975.

BASICE SERVICES

The following and restrictions of the same and the complete the comple

## Birch Creek

Aquatic habitat. Tables 10 and 11 contain a summary of the two stream habitat surveys taken on 26 June and 23 September, 1975. Most parameters measured on these two dates correlate closely; but there is a discrepancy between the bank stability ratings of the two dates. Two different workers did these surveys and apparently they disagreed on the characteristics of the various stability classes. The value of 89 percent optimum bank stability on 23 September is too high although there are reaches of stream with highly stable banks. Part of the difference was also due to the placement of the upper transects at S-4 100 meters further upstream on 23 September compared to 26 June. This placed three transects above a wire fence which limits grazing upstream and the bank stability above the fence was better than downstream. Plates V and VI contain photographs of the transects on Birch Creek.

There is heavy grazing along portions of Birch Creek which has resulted in lowering the total vegetative cover and stability of the stream banks. This shows up best with 59 percent optimum bank cover on both dates surveyed and 59 percent stability of banks on 26 June.

Birch Creek is a small stream and as such cannot provide habitat for a large fisheries nor can it maintain a stable biotic community if subjected to extensive environmental perturbations. Birch Creek has good aquatic habitat with the main limiting factor being the low summer and winter flows (less than 0.5 cfs mean). These low flows cannot provide the depths, flows, or habitat coverage required of a quality fisheries, but under optimal management could provide a critical habitat for the protection and survival of a pure strain wild trout fishery.

Water quality. Birch Creek is a moderately soft water, bicarbonate buffered, clear cold-water mountain stream (Table 12). Nutrients are adequate for production of a good algal community with nitrate nitrogen at S-1 ranging from 0.23 mg/l on 26 June to 0.08 on 23 September 1975 and orthophosphate at 0.07 mg/l on both dates. Nitrate and phosphate concentrations are not excessive.

Bacteria samples indicate significant levels of total and fecal coliform, but they were still well below the state maximum for Class C waters (Table 12). On 26 June 1975, there were numerous cattle at S-1 which could account for the 400/100 ml total coliform, 220/100 ml fecal coliform, and 155/100 ml fecal streptococci at this station. At S-4 counts were considerably lower with only 167/100 ml total and 42/100 ml fecal coliforms. There were fewer animal signs at S-4, but there were some beaver ponds upstream. On 23 September levels were higher at S-4, probably the result of cattle being moved higher on the mountain as the summer progressed. The sample from S-1 in September was destroyed in transport.

Aquable habitat. Tables to and il contain a summaty of
the two street habitat surveys taken on 25 lune and 23 September.

1975. Most parameters measured on thems two lates correlate

closely; but there is a discrepancy between the baph ordilly.

ratings of the two deems. The different workers did thems surveys
and apparently they discrepance on the characteristics of the various
stability classes. The value of 89 markeyt options bank stability
with highly stabils banks. Nect of the deems are reaches of stream
the placement of the upper transacte at S-6 100 meters further upditions
on 23 September scapered to 26 lune. This placed three transactes
above a wire fence which limits graving upstream and the bank
stability above the fence was better than downstream. Flates

y and VI contain photographs of the examples on the fransacts on strenge.

There is heavy granting elong portions of Birch Creek which has resulted in lowering the total vegetative cover and stability of the stream banks. This shows up heat with 59 percent aptimus bank cover on both dates surveyed and 59 percent atability of banks on 25 limits.

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community if subjected to extractive reviroussedal pertentiations

streb Crook has good squable bepites wild the wate limiting factor

being the low summer and winter thews (last them 0.3 ore deen).

These low flows cannot provide the deprine, flows, or bubilar coverage

required of a quality fisheries, but coder optimal namegousses

could provide a cristcal habitat for the protection and survival

Marat quality. Sirch Crack is a moderately soft tutor, bloarbopate buffered, clear cold-cater countain thream (Table 12), nutrients are adequate for production of a good algal columnity with nitrate airregar at 5-1 ranging from 0.23 me/1 on 26 lune to 0.08 on 23 September 1975 and exthephosphate at 0.07 me/1 on both dates. Micrate and phosphate concentrations are not rincarive.

Secretia samples indicate significant levels of sotal 225 feest coliform, but they were still well below the State maximum for Elses C waters (Table 13). On 25 June 1875, there were newstrow cattle at 5-1 which could account for the 400/100 ml total coliform, and 155/100 ml feest acceptances; at 5-4 counts were considerably lower with anly 167/100 ml total coliforms. There were fewer and actual signs at 5-6, but there were some beaver posts unattoons. On 23 September levels were bigher at 5-4, probably the result of the sample from 5-1 in September was destroyed in transport.



## PLATE V

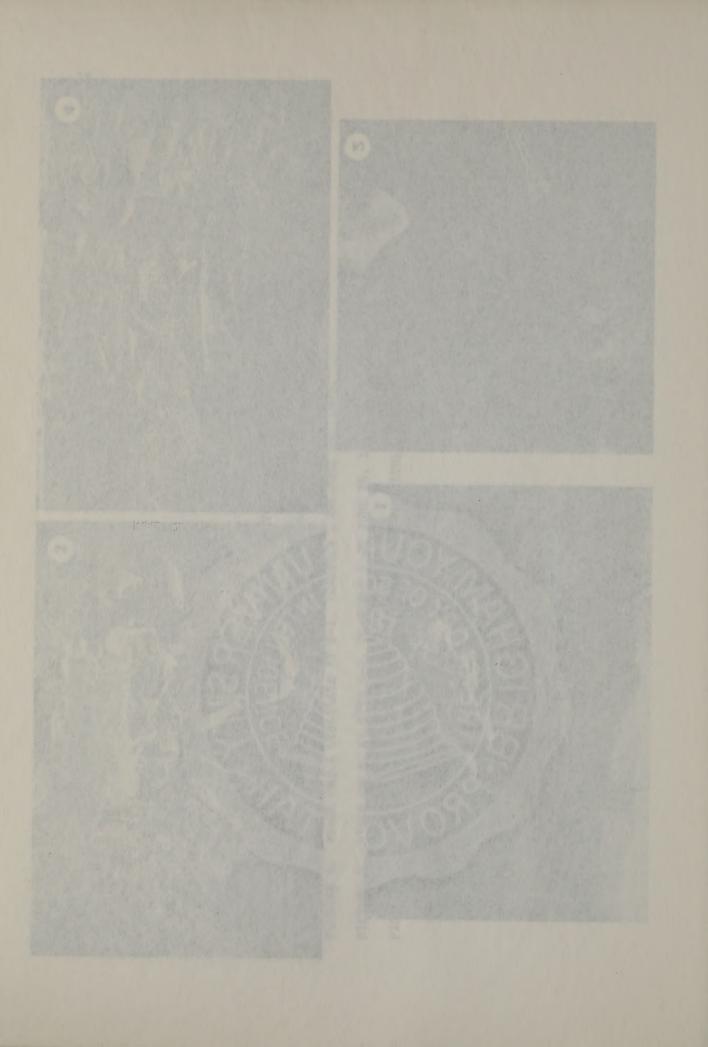
- PICTURE 1. BIRCH CREEK AT SITE S-1 BURN AREA ON JUNE 26, 1975.
- PICTURE 2. BIRCH CREEK SUBSTRATE AT S-1, TRANSECT 1 ON JUNE 26, 1975.
- PICTURE 3. BIRCH CREEK AT SITE S-2, TRANSECT 1 ON JUNE 26, 1975.
- PICTURE 4. BIRCH CREEK AT SITE S-2, TRANSECT 4, AT THE FISHLAKE FOREST BOUNDARY ON JUNE 26, 1975.

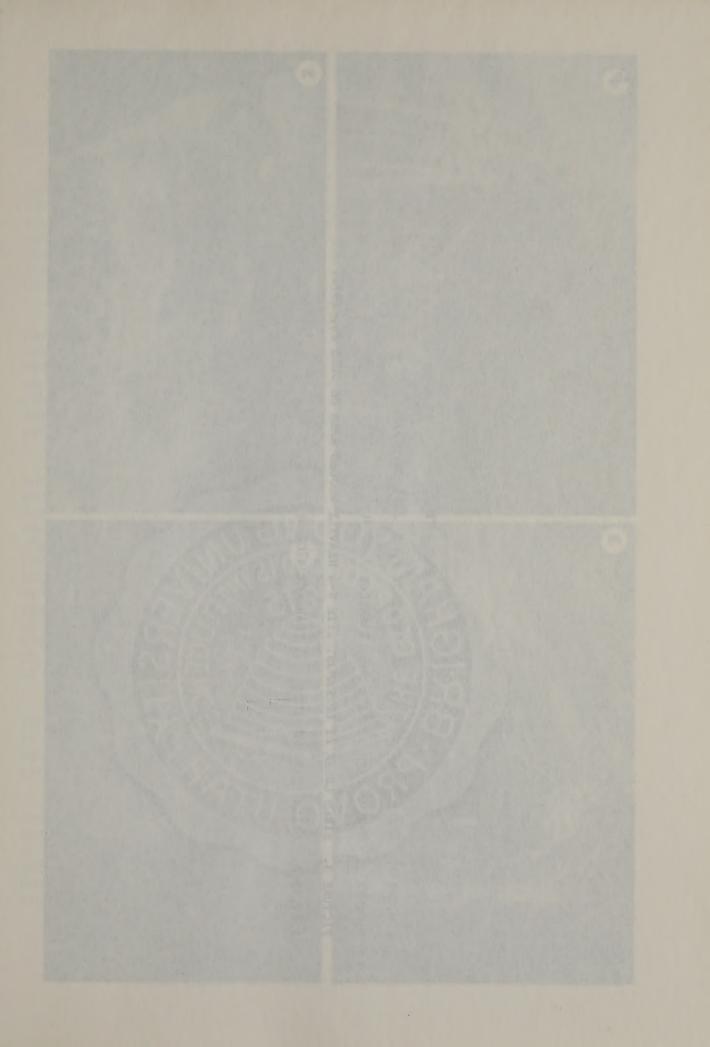






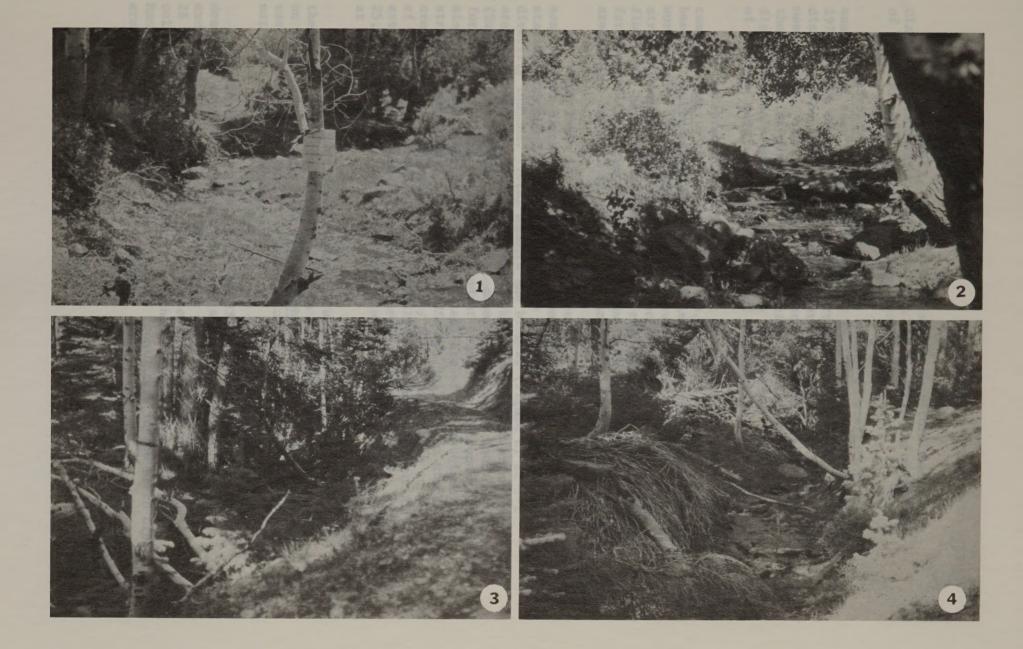


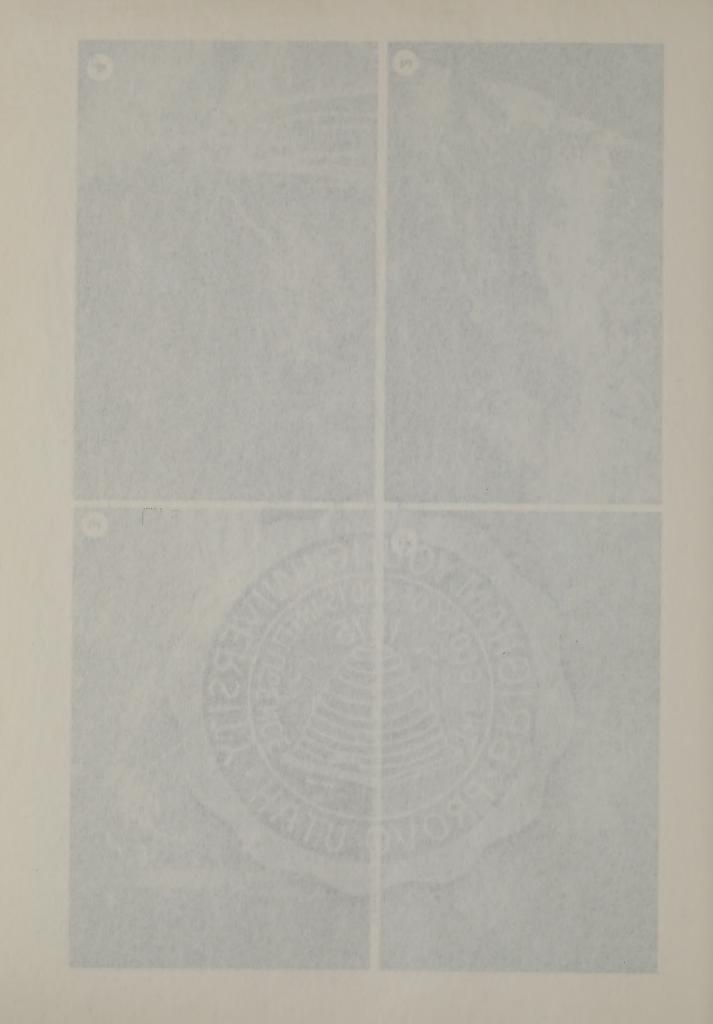




## PLATE VI

- PICTURE 1. BIRCH CREEK AT SITE S-3, TRANSECT 1, ON JUNE 26, 1975.
- PICTURE 2. BIRCH CREEK AT SITE S-3, TRANSECT 3 ON JUNE 26, 1975.
- PICTURE 3. BIRCH CREEK AT UPPERMOST SITE S-4 HEAVILY WOODED AREA ON JUNE 26, 1975.
- PICTURE 4. BIRCH CREEK AT SITE S-4, TRANSECT 4 ON JUNE 26, 1975.





Water quality, as far as determined, is within the state Class "CC" standards and adequate with the exception of quantity of water for most aquatic organism groups.

Macroinvertebrate communities. Table 13 presents a step analysis of sample statistics from S-2 on 26 June and 23 September 1975. On 26 June 1975, the macroinvertebrates were fairly evenly distributed as indicated by the low percent standard error of the mean (16.7), and coefficient of variation (33.4); but on 23 September the communities were highly clumped which resulted in the wide discrepancy in sample estimates with a 49.1 percent standard error of the mean and an 85.1 coefficient of variation.

In September, the main element of variation within samples came from <u>Baetis</u> spp. and <u>Cinygmula</u> sp. mayflies, elmid riffle beetles, chironomid midges, water mites (Hydracarina), and oligochaete worms (Table 15). Clustering could have been in response to the low stream flows (0.3 cfs) compared to June (0.8 cfs). This reduced flow would have resulted in a serious reduction in suitable habitat for some of these species, forcing them to crowd together in small areas which resulted in a larger variance in numbers between samples.

From Table 14, which gives a summary of macroinvertebrate samples from Birch Creek, it is apparent that S-1 is the poorest station with the lowest number of taxa and the lowest dominance diversity indices. Total numbers and biomass (Figure 8) at S-1 are good compared to the other sites, but the dominant organisms (Table 15), elmid beetles, are not considered quality food organisms for fish. The next three most abundant organisms (chironomid midges, simuliid blackflies, and baetid mayflies) are often associated with stressed communities, especially immediately following a stress. They are active drifters and are continually moving downstream in search of new areas of suitable habitat. Their reproduction potential is astounding; and following a hatch, there are often in excess of 25,000 young larvae per square meter in small brook areas, generally at upstream sites.

The dominant caddisfly at S-1 was <u>Hydropsyche</u> sp., one of the more tolerant caddisflies, but one requiring a stable substrate on which to attach its net. <u>Hydropsyche</u> sp. builds a net which it uses for attachment and as a food capturing device for trapping materials floating downstream.

With the exception of S-1 on 23 September, the d and H dominance diversity values (Table 14) are good with S-4 near excellent. There is good diversity at all sites with from 21 to 28 taxa sampled per site. Table 15 shows a complete list of taxa collected with relative numbers of each per site for each date. Many of these have never been reported from waters in the Birch Creek area, and some are new county records.

Class "CC" standards and staymans with the unseption of quentity of water for most squatte organism groups.

Mucrosaveriebrasa communistes. Table 13 presents a step analysis of semolo statistics from 5-2 on 26 lone and 13 September 1975. On 26 lone and 13 September 1975. On 26 lone as followed as indicated by the low percent standard error of the mean (16.7), and destinated of variation (33,6); het on 23 September the communistes were sighty visaped which resulted in the old with a fell percent standard error of the mean and as 85.1 coefficient of variation.

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Prom Table 16, which gives a summary of emercia sattebrate samples from Sirob Crask, at is apparent that 5-1 % the postest statement with the lowest sumber of tems and thousand diversity indices. Total simbers and biomass (Pinure S) at 5-1 are good compared to the time that the desilvant expenses (Table 15), almid befoles, are not summidely desilvant expenses for time. The news three sout them and summitted and the same that the services of the services with the services and the same in the services of our errors of suffers and the continues of our errors of suffers and the continues of our errors of suffers and news of the continues of our errors of suffers habitet. Their reproductive potential is active and in the reservices in the law of the services of

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With the enterprise of St. on 23 September 18th despite despit

S-4 has lower total numbers and biomass than S-1 or S-3. This is in direct response to the dense growths of evergreens along the stream which have out-compèted the deciduous plants for space and light. The removal of deciduous plants has reduced one of the major food sources for many species. Also, the thick canopy restricts sunlight to the stream which limits algal growth, another major food source for several species of macroinvertebrates. Streams in evergreen forest areas have characteristically lower production of macroinvertebrates than comparable streams in deciduous forests.

Birch Creek has the potential of supporting a quality aquatic system with the present major threats being from minimum flows and overgrazing of stream banks by livestock.

Management alternatives. Birch Creek has several management alternatives open to it. The approach depends upon the value set on it as a fisheries habitat. It is a small stream and as such will never be able to maintain a fisheries for harvest purposes. This means that a fisheries in Birch Creek will be mainly for maintaining the pure strain Utah cutthroat trout currently existing there but threatened by limited habitats in the intermountain area.

Management of aquatic habitat by federal land agencies should include:

- 1. Limited grazing on riparian vegetation, particularly grasses, to insure bank stability and stream cover;
- 2. Guaranteed minimum stream flows such as no diversion of water during periods of low flow;
- 3. Pool quality improvement such as increasing depth and cover of selected pools. Riffle habitats are of high quality with little sedimentation of interstitial spaces;
- 4. Management or elimination of existing beaver populations by the Utah Division of Wildlife Resources to prevent further degradation or elimination of critical limited riparian habitats, siltation of desirable stream substrate, and blockage of fish migrations; and
- 5. Continued surveillance of water and habitat quality, including macroinvertebrate sampling and vegetation mapping.

The stream, which have not constructed the decidious stands of orders along the stream, which have not compacted the decidious plants for opace and light. The removal of decidious plants has reduced one of the sajor rood sources for many species. Also, the chick samply restricted dumingst to the pareses which limits significantly another major food sources for several species of contrators the chick samply restricted every several species of contrators the chick sample of contrators are several species of contrators and a second contrators are also contrators and contrators are several several several several production of contrators the contrators and contrators are several contrators.

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Management oliveractives, birch Creek has several management alternatives open to 10. The approach depends spon the using was on it as a disherted habiter. It is a small errors and as such will never be ship to maderate a disherted to hervest purposes. This means that a disherted in hirdh Creek will be mituly for make training the pure sevels Utah outskroat trout currently extending there but threatened by limited beditters in the interference area.

Management of equatic habitat by federal land openation

- 1. Limited grading on circular constitutes, particularly ereces, to incure bank straility and attend towers
- 2. Contemport winings series flows such as no diversion of water during periods of low flows
- s. Fool quality improvement such my instraction depth and cover of splected pools. Alfile habitute are all high quality with little sedimentation of intercrital openes.
- to the Uest Division of Viidisia leaderses to prevent inches degree dector or elimination of cristed limited rightless bublists.
  - 5. Continued surrelliance of water and inditat quality including materials are surpling and vegetiation materials.

Table 10. Stream habitat survey summary and analysis for Birch Creek on  $26\ \mathrm{June}\ 1975$ .

1.	State, County	2. District		3. Resource Area	iP.U.
	Utah, Beaver	Cedar Cit	- 37	Reaver Rive	erBeaver Riv
4.	Drainage	5. Stream Unit			er-beaver KIV
	Beaver River	Birch Creek		6. Location T. 30S R. 60	Sect. 6
7.	Investigators Winget and Reichert			8. Date June 26, 1975	· in
	General Data		-	Priority A Limiting Fac	
_					
9.	Total length of stream (mi	<u>≃10</u>	25.	Percent of total stream win pools	41%
0.	Total length of stream surveyed (mi.)		26.	Pool-riffle ratio, % opti	mum 82
	a. BLM	2	27.	Pool quality, % optimum	53
	b. Public (USFS)	2			
	c. Private	Continues or Conti	28.	Percent of stream bottom with desirable materials	72
1.	Total No. sample stations:		29.	Percent spawning gravels	45
	a. BLM	2	30.	Bank cover, % optimum	59
	b. Public (USFS) c. Private	2			
	c. flivate	-	31.	Bank stability, % optimum	59
2.	Total of all stream width		32.	Percent of habitat optimu	m 65
	measurements (ft.)	76			
				Priority B Limiting Fac	tors
3.	Total channel width (ft.)	227			0.00
	Total widthall pools (ft	.) 31	33.	Average depth of stream (	-
	Total widen all pools (10	• / 31	34.	Average width of stream (	ft.) 4.75
	Total width of all pools		35.	Average width of channel	(ft.) 14.2
	classed 1, 2, and 3 (ft.)	20	36.	Percent of bottom with clinging vegetation (ft.)	≃10
5.	Total footage of desirable	55	0.7		
	bottom materials (ft.)	33	37.	Percent of bottom with rooted vegetation (ft.)	≃2
7	Total spawning gravels (ft	.) 34			
			38.	Percent stream shade	48
3.	Sum of cover ratings	75	39.	Average stream gradient (	%) <u>4.3</u>
	Sum of stability ratings	76	40.	Average stream velocity (	f/s) 0.72
	Jan of Deadliffy Lacings	-	41.	Stream discharge (cfs)	0.90
).	Elevation: (MSL)				
	a. Lowest b. Highest	7,060 7,800	42.	Average water temperature (°F or °C)	12° C
	W.1.4-1-		43.	Average Air Temperature	
. •	Multiple use zones cattle			(°F or °C)	21° C
	recreat	ion	44.	Turbidity description (cl	ear) 3 JTU
			45.	Access (mi.):	
	Number of camera points			a. Remote	
				b. Low standard trails	
	Total cost			c. Improved trails	
	a. Planning b. Salaries			d. Low standard roads	8
	c. Equipment	-		e. Improved roads	
	d. Analysis of data	-	46.	Water quality analysis:	
	Cost per station	-		<ul><li>a. Hach kit (pH, DO, to</li><li>b. Chemical (BYU)</li><li>c. Coli (Bionics)</li></ul>	ur., CO <sub>2</sub> , Spec. Con X X

Table 10. Street babiest survey sympaty and analysis for Sirch

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Table 11. Stream habitat survey summary and analysis for Birch Creek on 23 September 1975.

1.	State, County 2.	District			3. Resource AreaP.U.	
	Utah, Beaver	Cedar City	V7		Beaver RiverBea	ver River
4.	Drainage 5.	Stream Unit	,		6. Location	VCI ILIVCI
	Beaver River	Birch Creek			T. 30S R. 6W Sec	t.6
7.	Investigators Reichert and Cluff				8. Date 23 September 1975	
	General Data			Prior:	ity A Limiting Factors	
9.	Total length of stream (mi.)	<u>~10</u>	25.	Percent	of total stream width	
0.	Total length of stream			in pools		36%
-	surveyed (mi.)		26.	Pool-ri	ffle ratio, % optimum	
	a. BLM	2	27.	Pool qua	ality, % optimum	60
	b. Public (USFS)	2	28.	Percent	of stream bottom	
	c. Private			with des	sirable materials	91
1.	Total No. sample stations:		29.	Percent	spawning gravels	71
	a. BLM	2				59
	b. Public (USFS)	2	30.		ver, % optimum	
	c. Private		31.	Bank sta	ability, % optimum	89
2.	Total of all stream width		32.	Percent	of habitat optimum	74
٠.	measurements (ft.)	69				
	The state of the s			Prior:	ity B Limiting Factors	
3.	Total channel width (ft.)	244				0.10
,	m-a-1 1a1 1 (6a )	2/ 5	33.	Average	depth of stream (ft.)	0.18
4.	Total widthall pools (ft.)	24.5	34.	Average	width of stream (ft.)	3.5
5.	Total width of all pools		35.	Average	width of channel (ft.)	12.5
	classed 1, 2, and 3 (ft.)	20.5	36.		of bottom with	
			50.		g vegetation (ft.)	≃1%
6.	Total footage of desirable	62	27		of bottom with	
	bottom materials (ft.)	63	37.		vegetation (ft.)	<1
7.	Total spawning gravels (ft.)	49	20			
			38.	Percent	stream shade	
8.	Sum of cover ratings	95	39.	Average	stream gradient (%)	5
9.	Sum of stability ratings	143	40.	Average	stream velocity (f/s)	0.94
	Jul of Stability fatings	143	41.	Stream d	discharge (cfs)	= 0.36
0.	Elevation: (MSL)				0.27, S-4 = 0.44) water temperature:	
	a. Lowest	7,060	42.	(°F or		9.6° C
	b. Highest	7,800	4.0		1222 24 1 1	
1.	Multiple use zones cattle graz	zina	43.	Average (°F or '	Air Temperature	21° C
	recreations			,		
			44.	Turbidit	ty description	14.5 JTU
			45.	Access	2-40 JTU) (mi.):	
2.	Number of camera points	12			emote	
2	Total				ow standard trails	
3.	Total cost a. Planning				nproved trails ow standard roads	8
	b. Salaries				mproved roads	-
	c. Equipment		10			
	d. Analysis of data		46.		uality analysis:	v Cros
					ach kit (pH, DO, CO <sub>2</sub> , Tu hemical (BYU)	X
4.	Cost per station	-			oli (BYU)	X

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		Popular Company	Mary allowants and recognition (1).	[
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Table 12. Water quality analysis of Birch Creek.

		26 June	1975	23 Sept	ember 1975
nalysis by	s* Test	S-1	S-4	S-1	S-4
	Time	0950	1715	0830	1500
j.	Alkalinity, total as CaCO2, mg/l	61	56	62	45
-	Alkalinity, total as CaCO <sub>3</sub> , mg/l Bicarbonate as HCO <sub>3</sub> , mg/l	74	68	76	55
- 15	Boron as B, mg/1				-
- 3	Calcium as Ca, mg/1	13	12	16	11
3	Carbonate as CO <sub>3</sub> , mg/1	<0.1	<0.1	<0.1	<0.1
	Chloride as Cl, mg/l	1	1	1	<1
	Conductivity, µmhos/cm (25° C)	88	87	90	80
	Hardness as CaCO3, mg/1	113	107	97	45
	Hydroxide as OH, mg/1	<0.1	<0.1	<0.1	<0.1
	Magnesium as Mg, mg/l	19	19	14	4
	рН	7.9	7.6	7.6	7.6
	Potassium as K, mg/1	2.7	2.5	2.5	2.3
	Sodium as Na, mg/1	4.7	4.5	4.9	4
	Sulfate as SO <sub>4</sub> , mg/l	13	10	8	7
	Total Dissolved Solids	118	118	123	99
	Turbidity, JTU's	clear	3	12	4
	Dissolved Oxygen as 0 <sub>2</sub> , mg/1		8.0	10	9
	Nitrate as N, mg/l	0.23	0.22	0.08	0.0
	Phosphate (Total) as P, mg/1	0.070	0.055		
	Phosphate (Ortho) as P, mg/1	0.070	0.055	0.072	0.0
	Air Temperature, °C	19.0		18	22
	Water Temperature, °C	8.5	13.0	5	9.5
, 1	Total Coliform, MPN/100 ml	400	157	515-4 m	460
, 1	Fecal Coliform, MPN/100 ml	220	. 42		23

\*1. BYU Environmental Analysis Laboratories

2. USGS

3. Field determinations

4. Bionics

5. Utah Department of Health and Welfare

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<sup>5,</sup> west bepartment of Beelth and wellers

Table 13. Statistics for stepwise pooled samples for Birch Creek Site S-2 on 26 June 1975 and 23 September 1975.

Step*	Total No. of Taxa	Mean No/ft <sup>2</sup>	80% Confidence Limits LL	80% Confidence Limits UL	Standard Deviation	Percent SE of Mean	Coefficient of Variation	ŀΦ	н
26 June 1975									
1	22	undefined	undefined	undefined	undefined	undefined	undefined	2.80	2.75
2	28	1,264.5	832.0	1,697.0	198.7	11.1	15.7	2.75	2.72
3	28	1,032.0	567.6	1,496.4	426.5	23.9	41.3	2.78	2.75
4	29	1,044.0	758.1	1,329.9	349.1	16.7	33.4	2.82	2.80
23 September 1975									
1	19	undefined	undefined	undefined	undefined	undefined	undefined	2.75	2.62
2	24	538.5	-63.2	1,140.2	276.5	36.3	51.3	2.87	2.81
3	27	1,033.67	75.8	1,991.5	879.6	49.1	85.1	2.96	2.93

<sup>\*</sup>Step 1 consists of only one sample; Step 2 is the results from 2 pooled samples; Step 3 is the results from 3 pooled samples, etc.

Table 13. Statistics for stopsiss pooled samples for Sirch Creek Site S-2 on 26 June 1975 an

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	7:035-0		1,4904			
	780445					
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Figure 1 commandered of cally one neograph Step 2 to the resident from 2 pooled neophops Step 2 to the resident

Table 14. Summary of macroinvertebrate community analysis for Birch Creek on 26 June 1975 and 23 September 1975.

									Ω Ω		
									att		
Sampling Site	Number of Taxa	Total $\bar{x}$ Number/ $^2$	% Ephemeroptera	% Plecoptera	% Trichoptera	1.100 A.	% Coleoptera	% Diptera	% Other Invertebrates	טיו	щ
S-1									an nilar		
26 June 1975	22	16,398	8	1	4		43	41	4	2.41	2.37
23 September 1975	21	13,579	15	1 3	5		68	7	2	1.88	1.84
0.0											
S-2 26 June 1975	29	11,277	9	1	2		27	1.1	0	2 02	2 00
23 September 1975	27	11,147	37	2	3		37 30	41 12	9	2.82	2.80
23 September 1973	-,	11,17	3,				30	1.2		2.90	2.33
S-3											
26 June 1975	30	23,521	10	2	3		23	43	19	2.90	2.86
23 September 1975	25	19,131	11	4	6		29	40	10	2.72	2.68
S-4											
26 June 1975	28	7,726	16	4	7		21	30	22	3.38	3.28
23 September 1975	28	9,738	53	11	3		11	14	8	3.26	3.18
		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		1			all all			3.20	3.10

Table 14. Summary of macroinvertebrate community analysis for Strob Greek on 26 June 1975 and

	S. Canadanie Z Leacon		ETBOUGOST X			
		10				

Table 15. Number per meter square of macroinvertebrate taxa collected from Birch Creek.

Mile LS, (marrow)		26 June	e 1975			23 September 1975				
Taxa	S-1	S-2	S-3	S-4	S-1	S-2	S-3	S-4		
Phylum Aschelminthes		0/7	1 (20							
Class Nematoda	32	247	1,679	86	0	183	75	22		
Phylum Mollusca	0	0	0	_			2.2			
Class Pelecypoda	U	U	U	0	0	11	22	0		
Phylum Annelida	201	E02	1 700	F(0	161	120	1 0/0	201		
Class Oligochaeta	291	592	1,786	560	161	430	1,248	291		
Phylum Arthropoda Class Arachnida										
Order Acarina										
Suborder Hydracarina	334	420	2,625	1,108	172	624	689	517		
Class Crustacea	334	420	2,023	1,100	1/2	024	009	21/		
Order Ostracoda	0	0	0	0	0	0	0	11		
Order Copepoda	0	0	22	32.	0	0	0	11		
Order Cladocera				-						
Family Daphnidae										
Daphnia sp.	0	22	0	0	0	0	0	0		
Class Insecta				٠						
Order Collembola	11	0	0	11	0	0	0	0		
Order Ephemeroptera										
Family Siphlonuridae										
Ameletus sp.	0	0	11	0	0	22	0	11		
Family Baetidae							`			
Baetis spp.	1,033	506	1,528	430	1,636	3,153	1,410	2,787		
Family Heptageniidae			1000							
Cinygmula sp.	0	32	172	183	118	721	549	1,636		
Rhithrogena sp.	0	22	11	0	0	0	22	11		
Epeorus sp.	151	97	377	441	0	0	0	334		
Family Leptophlebiidae	- 11	015	22	7.5	194	238	43	75		
Paraleptophlebia sp. Family Ephemerellidae	11	215		75						
Ephemerella sp.	97	139	237	54	0	0	0	0		
Ephemerella inermis	0	0	11	11	0	0	86	258		
Ephemerella doddsi	0	0	. 22	43	0	0 22	0	65 11		
Ephemerella grandis Family Tricorythidae	11	U	11	U	22	22	11	11		
Tricorythodes sp.	0	0	0	0	75	0	0	. 0		
Order Plecoptera										
· Family Nemouridae										
Amphinemura mogollonica	0	0	0	0	0	0	A	A		
Zapada sp.	0	43	86	0	0	43	43	183		
Family Capniidae	0	0	0	. 0	334	118	667	796		
Family Leuctridae	0	0	0	0	0	0	0	11		
Family Pteronarcidae										
Pteronarcella badia Family Perlodidae	86	32(A	) 65(A	) 11	32	0	0	0		
Isoperla spp.	0	0	0	11	0	0	0	0		
Other Perlodidae	0	0	22	0	. 0	0	0	. 0		
Family Chloroperlidae		- 44		12						
Suwallia pallidula	0	A	0	0	0	0	0	0		
Sweltsa lamba	0	A	A	0	0	0	0	0		
Triznaka pintada	0	0	A	0	. 0	0	0	0		
Other Chloroperlidae	0	0	183	151	32	11	0	43		

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Table 15. (continued)

		26 Jur	ne 1975			23 Sept	ember 197	5
Таха	s-1	S-2	S-3	S-4	S-1	S-2	S-3	S-4
Family Perlidae								
Hesperoperla pacifica	11	22	54	75				_
Other Plecoptera	86	32	54	43	0	54	75	7
Order Hemiptera		32	24	43	U	. 0	0	
Family Nabidae	0	0	0	0	11	0	- 0	
Order Trichoptera		•	Ů	0	11	U	0	
Family Rhyacophilidae								
Rhyacophila sp.	0	0	97	118	0	0	0	
Family Glossosomatidae			31	110	U	U	0	- 3
Agapetus sp.	0	11	11	0	0	22	108	
Family Hydropsychidae				0	U	- 22	100	
Hydropsyche sp.	463	22	581	355	581	796	861	18
Arctopsyche sp.	0	0	0	11	0	32	22	1
Other Hydropsychidae	65	0	0	. 0	0	0	0	
Family Limnephilidae	0	0	32	Ö	43	140	54	
Family Lepidostomatidae	0	32	0	32	0	0	0	
Family Brachycentridae		3-	0	32		U	0	
Brachycentrus sp.	11	0	11	0	0	0	0	
Micrasema sp.	0	0	0	0	0	75	65	
Other Trichoptera	75	43	0	o o	0	0	. 0	
Order Hymenoptera					-		0	
Suborder Chalcidoidea	0	0	0	0	0	11	22	
Order Coleoptera			Tar.	-			2.2	
Family Elmidae	6,973	4,121	3,515	1,646	9,168	3,293	5,584	1.0
Optioservus quadrimacu:	latus	1				-,-,-	5,501	1,0.
Narpus sp.								
Family Dryopidae	. 0	0	0	0	11	11	0	
Family Dytiscidae	22	11	0	0	0	0	0	
Family Gyrinidae	0	0	0	11	0	0	. 0	
Order Diptera					. 466			
Family Tipulidae								
Antocha monticola	32	97	409	43	11	118	506	
Dicranota sp.	0	22	0	0	32	32	65	
Hexatoma sp.	0	11	0	0	0	11	0	
Other Tipulidae	- 0	11	0	11	0	22	11	
Family Psychodidae	32	32	97	43	75	11	0	:
Family Dixidae								
Dixa sp.	0	0	0	0	43	32	11	
Family Simuliidae	3,809	2,163	624	291	11	22	11	3
Simulium sp.								
Family Chironomidae	2,776	2,163	8,640	1,872	786	1,076	6,919	1,23
Family Ceratopogonidae	. 22	129	258	75	43	22	54	
Family Empididae	11	22	140	11	0	0	22	
Family Ephydridae	0	11	0	11	0	0	0	
Family Muscidae								
Limnophora sp.	0	11	0	. 0	0	0	0	

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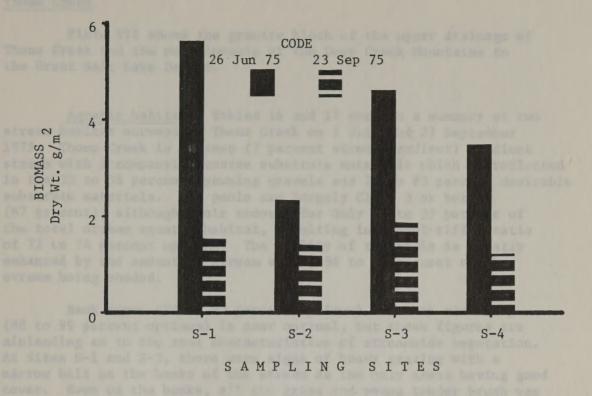


Figure 8. Comparison of macroinvertebrate standing crop (biomass) at four sites on Birch Creek on 26 June 1975 and 23 September 1975.

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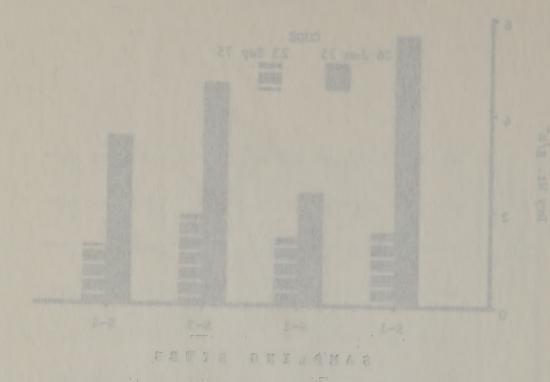


Figure 8. Comparison of mentoderest division attending croft.
(biomage) at fout sizes on Sirch Oriest on 2s June 1879
and 23 Suprember 1875.

## Thoms Creek

Plate VII shows the granite block of the upper drainage of Thoms Creek and the relationship of the Deep Creek Mountains to the Great Salt Lake Desert.

Aquatic habitat. Tables 16 and 17 contain a summary of two stream habitat surveys of Thoms Creek on 1 July and 27 September 1975. Thoms Creek is a steep (7 percent stream gradient) gradient stream with accompanying coarse substrate materials which is reflected in the 33 to 56 percent spawning gravels and 70 to 83 percent desirable substrate materials. The pools are largely Class 3 or better (67 percent), although pools account for only 36 to 37 percent of the total stream aquatic habitat, resulting in a pool-riffle ratio of 72 to 74 percent optimum. The quality of the pools is greatly enhanced by the amount of stream shade, 84 to 85 percent of the stream being shaded.

Bank cover (87 to 90 percent optimum) and bank stability (88 to 99 percent optimum) is near optimal, but these figures are misleading as to the real characteristics of streamside vegetation. At Sites S-1 and S-3, there were signs of heavy grazing with a narrow belt on the banks of the stream as the only areas having good cover. Even on the banks, all the grass and young tender brush was gone between the trees and brush. The stream banks were stable mainly because of dead brush, logs, and rocks along the edge of the stream channel, and only a small portion of stability was because of live vegetation.

At the present, Thoms Creek is fairly stable with good cover, but under present use the areas surveyed will continually decrease in quality of aquatic habitat. Plates VII to IX show aquatic habitat of Thoms Creek at the time of this survey.

Water quality. Thoms Creek, as suspected of a stream running through granitic substrates, is a soft-water, low alkalinity, clear cold-water mountain stream (Table 18). With the steep stream gradient and coarse substrate materials, the water flow is turbulent, keeping the concentration of dissolved oxygen near saturation. All parameters measured fall within Utah's Class C standards for a cold-water fishery stream.

Nutrient levels are low but not limiting to a fair algal growth. Nitrate and phosphate levels are seasonal with yearly high levels during spring and early summer, associated with leaching from leaves and other organic materials decomposed during winter snow cover.

Thoms Creek

Place VII shows the granite block of the upper drainage of Thoma Creek and the reletionship of the Deep Craek Mountains to the Great Selt Lake Deattr.

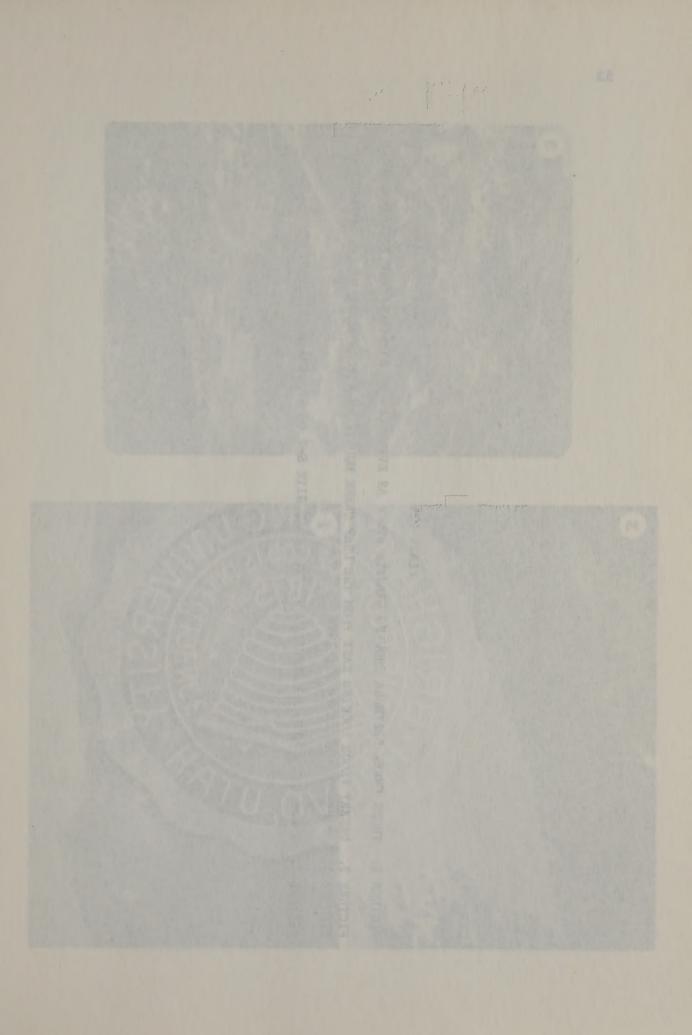
Aquatic habitet. Tables 16 and 17 courain a summary of two stream habitet surveys of thous Greek on 2 July and 27 September 1975. Thous Greek is a summy of percent erresm gradient, gradient erresm with accompanying course substrate materials which is reflected in the 23 to 36 percent spanning gravels and 70 to 83 percent desirable substrate materials. The pools are largely Glass 3 or better the total stream equants noblest, resulting only 36 to 37 percent, of the total stream equants noblest, resulting in a year-rifle ratio of 72 to 74 percent oprisms. The finality of the peois is greatly enhanced by the amount of stream shade, 64 to 85 percent of the stream being shaded.

Name cover (5) to 90 percent optimus) and printed at these disputes ere at 12 percent optimus) is near very all, but these disputes ere at 12 percent optimus) is near very all, but these disputes ere at 12 percent optimus of the stress of beave greates which a percent best of the stress as the opty ereas baying good cover. Even on the bash, all the great and very ereas broken bear at 200 percent beauth of the great and to the stress of the stress

At the present, There Creak is fairly exable with good cowers, but moder present use the areas corveyed will continually decrease in quality of equatic habitet. Places WI to IN show aquatic habitet of Thoma Creek at the time of this survey.

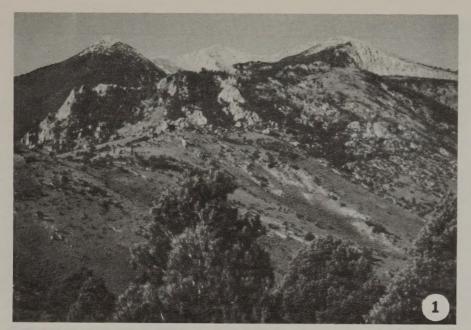
Varer quality. Those Creek, as stapected of a forcing running through granical substrates, is a soft-water, low elferlinky, clear cold-water expends in street (Table 16). With the stape arread gradient and course substrate materials, the water first is turbolent, keeping the consentration of bloselyed cayen sear actuation. All parameters measured fall within Utable Class C standards for a cold-water Stabery stream.

Mutricut levels are low but not lighting to a feit cigal growth. Mirrare and phosphare levels are account with yearly bigh levels during spring and early number, associated with leaching from leaves and other organic materials decomposed during winter and cover.



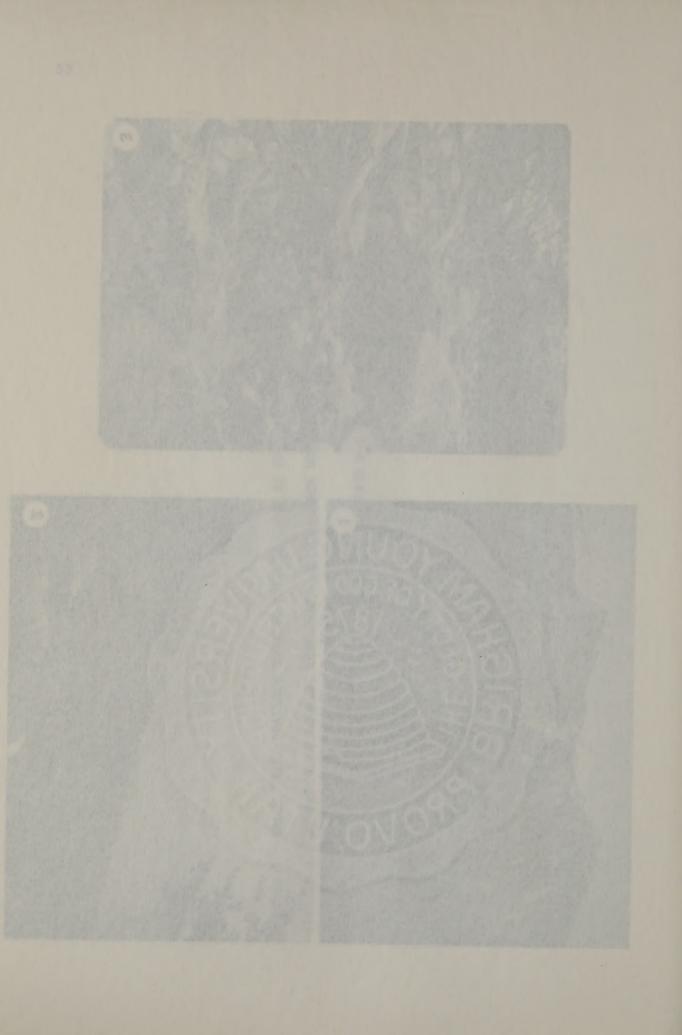
## PLATE VII

- PICTURE 1. THOMS CREEK DRAINAGE SHOWING GRANITE STOCK AS EVIDENCED BY HAYSTACK PEAK TO THE SOUTH.
- PICTURE 2. DESERT FLOOR LOOKING EAST FROM THE DEEP CREEK MOUNTAINS ACROSS SNAKE VALLEY TOWARD THE FISH SPRINGS RANGE ON SEPTEMBER 27, 1975.
- PICTURE 3. THOMS CREEK SHOWING GRANITIC SUBSTRATE AT SITE S-2 ON SEPTEMBER 27, 1975.





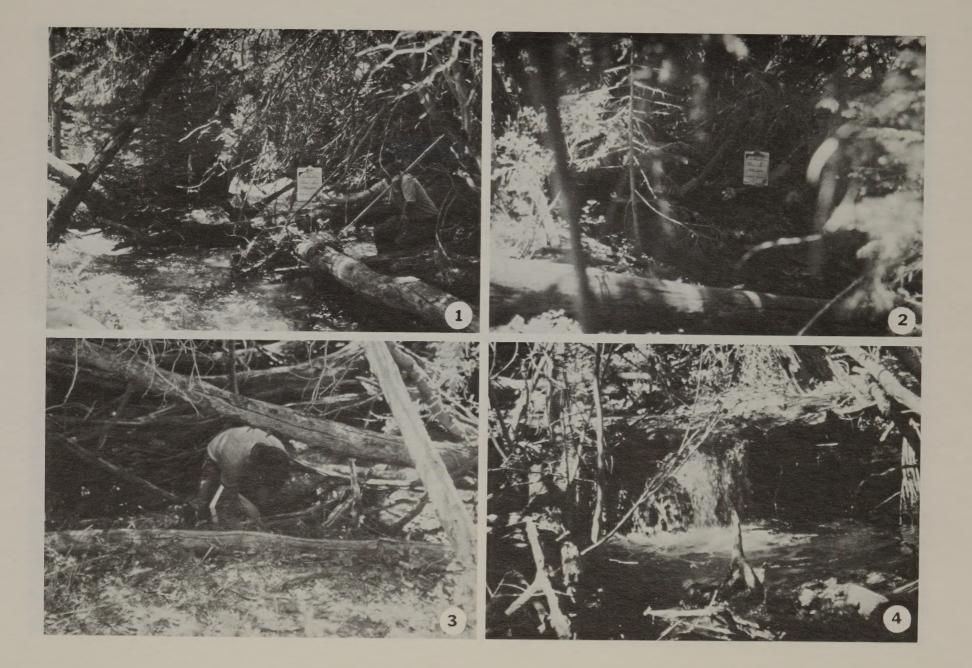




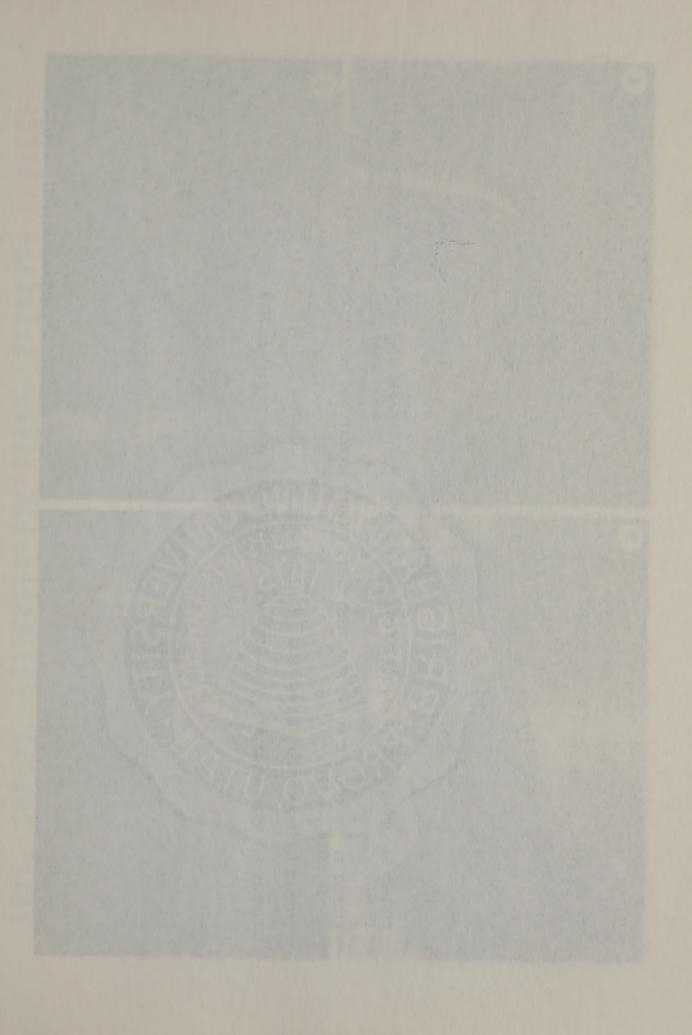


## PLATE VIII

- PICTURE 1. THOMS CREEK AT SITE S-1, TRANSECT 1 SHOWING DENSE FOREST GROWTH AND STREAM COVER ON JULY 1, 1975.
- PICTURE 2. THOMS CREEK SHOWING HEAVILY WOODED NATURE OF SITE S-1 ON JULY 1, 1975.
- PICTURE 3. THOMS CREEK AT S-3 SHOWING ABUNDANT DEADFALL ON SEPTEMBER 27, 1975.
- PICTURE 4. THOMS CREEK AT S-2 SHOWING CLASS 1 POOL ON SEPTEMBER 27, 1975.

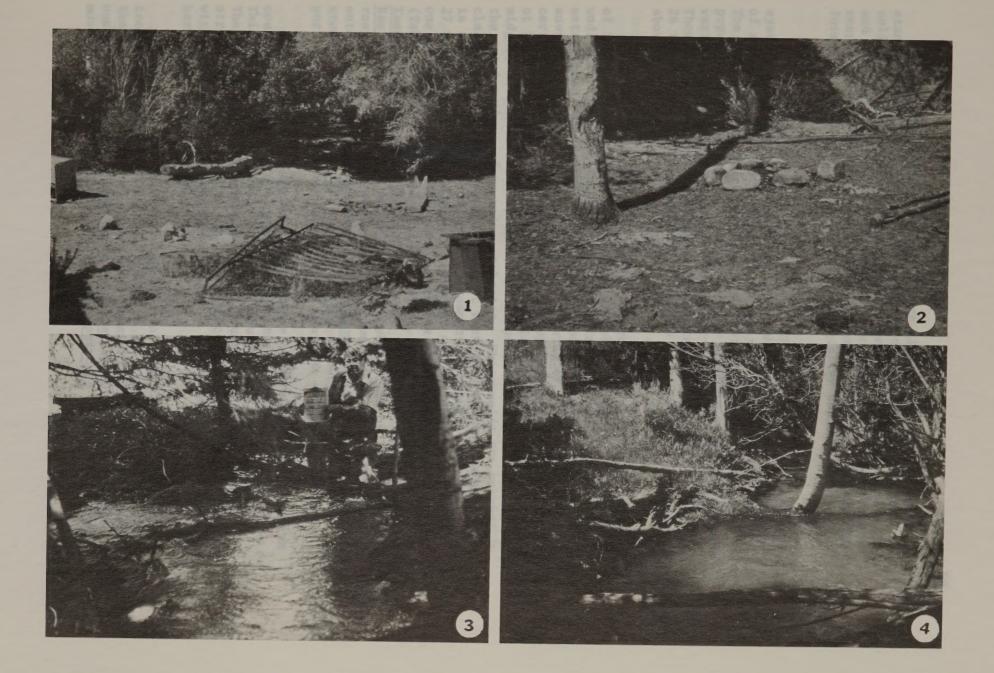


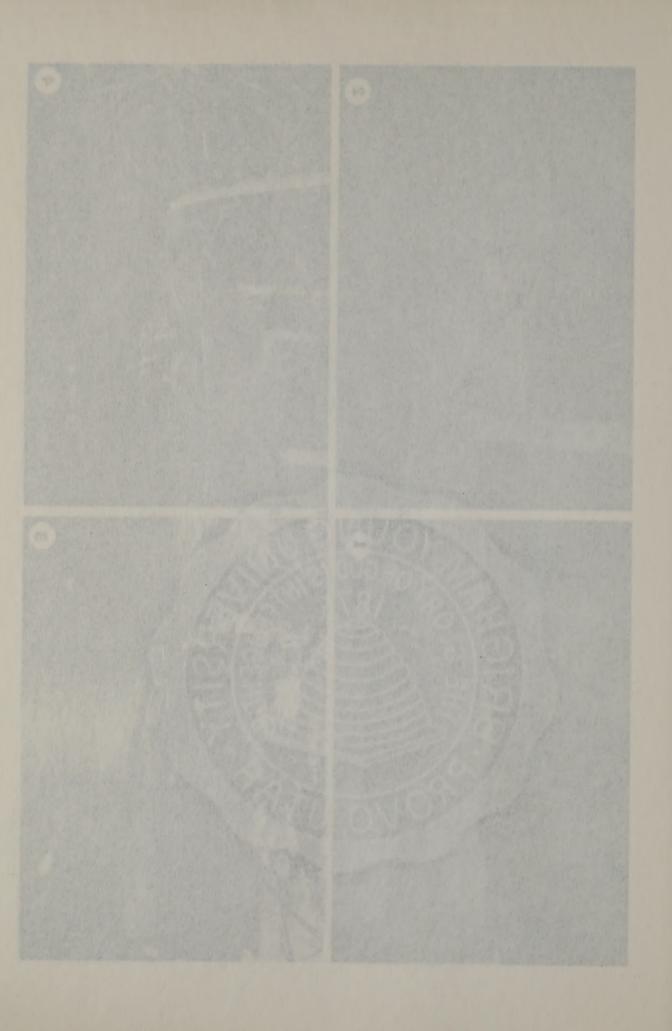




## PLATE IX

- PICTURE 1. THOMS CREEK AT S-3 NEAR FIRST CABIN ON SEPTEMBER 27, 1975 SHOWING GRAZING AND RECREATION IMPACT.
- PICTURE 2. THOMS CREEK AT S-3 NEAR FIRST CABIN SHOWING RECREATIONAL AND GRAZING IMPACT NEAR STREAM ON SEPTEMBER 27, 1975.
- PICTURE 3. THOMS CREEK SHOWING GOOD SHADE AND COVER AT S-3 ON JULY 1, 1975.
- PICTURE 4. THOMS CREEK AT S-3 SHOWING BANK STABILITY AND COVER ON JULY 1, 1975.





Bacteria levels (Table 18) were all considerably below the standards for Class C waters with a high of 210 total and fecal coliform per 100 mls at S-1 on 27 September 1975 and 138 total and 23 fecal coliform per 100 ml at S-3 on 1 July and 27 September, respectively. Cattle probably account for the majority of the coliform bacteria in Thoms Creek during the grazing season.

Macroinvertebrate communities. Thoms Creek is an interesting system in relation to biotic quality. Table 19 presents a summary of sampling reliability using a step analysis of pooled samples. The aquatic communities are slightly clustered, but estimates of population characteristics are relatively accurate with only moderate variance. Table 20 presents a summary of sampling data showing Thoms Creek to have a diverse macroinvertebrate community with from 26 to 36 taxa per site and d and H values from 2.21 to 3.75, all above any critically low value.

There are several signs of concern shown in the analyses of Table 19. The high diversity is probably the result of good, undisturbed habitat in past years, allowing many species to become established and adapted to the varied habitat niches. With increasing environmental pressures, such as overgrazing of streamside vegetation, certain indicator species are showing their responses. For example, at Sites S-1 and S-3 on 1 July 1975, dipterans (mainly chironomid midges) accounted for 67 percent and 63 percent, respectively, of the total numbers of macroinvertebrates. Chironomids are present in clean-water, diverse communities; but when they become dominant, it is usually in response to some environmental perturbation. On 27 September 1975 at Site S-1, there was not any dominance by any one taxa, but chironomids and oligochaete worms were still abundant (Table 21). At Site S-3 on 27 September, Baetis spp. (mayflies) and Taenionema nigripennis (stoneflies) were the two most dominant forms. Baetis spp. are a type of mayfly with a short life cycle and quick response to environmental stress, being one of the first forms to enter an area following a stress. Taenionema nigripennis is a stonefly with a short life cycle and the ability to survive harsh periods in the egg stage in a form of diapause or inactivity.

It is possible that the dominance of these specialized forms could be the signal to a degenerative situation in Thoms Creek. This is purely supposition but not without supportive evidences. The presence of large amounts of dead brush and trees along the stream tell of past times with dense streamside vegetation, probably with associated plush growths of grass. Now there is extensive bare soil and dead vegetation.

Many of the macroinvertebrates in Thoms Creek are detrial feeders or leaf shredders and feeders on leaf particles produced by the shredders. Among the shredders, possibly the most significant one is the stonefly, Pteronarcys princeps, which is rare throughout most of the state of Utah. Pteronarcys princeps is common, though,

59

Backeria isonia (Table 18) were all considerably below the electricity per the standards for Class C waters with a bigo of 210 rotal and facal coliform per 100 at a 3 on 17 September 1975 and 130 retain and 23 fecal coliform par 100 at as 3 on 1 July and 130 retain rotal responsitively. Cartie probably account for the selection of the coliform backeria to Thomas from the serving seasons.

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There are enverse, alone of ceacun about the condition of which are conditions of white and diversity to product the resident way epoches to be conditioned and staged to peace points, allowers many epoches to be conditioned and staged to the resided bailtax michael. With increasing convitational accordance and as everydaring of attractable vegetations and their responses. For enderly, an estaged to the conditions of a condition of the conditions and the conditions of a condition of the conditions are the conditions of a condition of the conditions of the conditions of a condition of the conditions o

torical final laterage species to specimental and made appropriate to the second secon

tong of the meanthcontrollers on less particles produced by feeders or less produced by the elredders. Among the whiteless, possibly the most electronic one is the the state of Utelements principle, which is the three-chart past of the state of Utelements of the state of Utelements of the state of Utelements of the state of the

in the Sierra Nevada Mountains, which are similar in geological formation to the Deep Creek Range. This species may provide the clue to the real relationships of the Deep Creek Mountain cutthroat trout to other isolated strains such as the ones in the Sierra Nevada Mountains. The detrital feeders rely almost entirely for their food on terrestrial leaves entering the stream during the fall. With the demise of streamside deciduous vegetation will come the demise of these forms of stream invertebrates in Thoms Creek.

It is evident that future study is needed of Thoms Creek to determine if a trend is really developing and if so, corrective management measures should be taken. At present there is a high quality diverse macroinvertebrate community in Thoms Creek and correct management efforts should produce excellent results. Macroinvertebrate community evaluations should be continued.

Biomass (Figure 9) of the macroinvertebrate community of Thoms Creek is low; but this is not uncommon in soft-water, high mountain streams. The invertebrates in this stream are generally small, but their high numbers help guarantee exposure of adequate biomass to feeding fishes in the stream.

Management alternatives. Thoms Creek is still a high quality, fairly unique aquatic system, at least for Utah. There are signs of a downward trend in water quality as a result of heavy domestic grazing.

Water flows are small and any diversions of water above the canyon mouth should be prevented. The minimum summer and winter flows are apparently adequate to maintain a diverse aquatic community, but lower flows could result in temperature, dissolved oxygen, and/or habitat availability stresses causing a reduction in the diversity and density of the existing community.

Nutrient levels were not high enough on either sampling date to cause alarm so animal wastes are probably not the main threat to the stream; but loss of dense streamside vegetation from overgrazing could have drastic effects. Removal of streamside vegetation can cause extreme water temperature increases from uncontrolled solar radiation and allow severe bank erosion and stream channel siltation.

The most logical management alternative would be to limit domestic animal access to the stream to selected short stream sections. The major part of the stream should be fenced to provide a buffer zone on both sides of the stream, the width dependent upon bank stability. This would allow growths of dense vegetation which would provide bank stability, stream cover, and shade and habitat for many species of wildlife. Grazing would still be allowed on the watershed, but animal-days should be controlled. This would be the optimal management alternative for multiple-use of this valuable resource.

in the Starts Reight Mountain's which are similar in geological formation to the feet Creit lange. This apactes may provide the class class to the real relationaries of the Start Rountain cutthroat trout to einer reclared eriation even as the cone in the Start Roundand Mountains. The detries seeks tely almost entirely for their food on currential lustes entering the house of the fell. With the demise of streamstad decidences represented will come the demise of these forms of stream invariables as those Creek.

ge is evident that funded study in period of these to describe describes if a son tective canagement measures chould be taken. At process there is a mach consistent divisors there is a mach consistent describes and three canagement efforts should produce excellent results. Macrolovertent brate constitute describes and the continued.

Plomas (Algare 9) of the merudamentebrate community of Thoma Creek to leve but this is not societies in self-versor, bight mountain erforms. The investibilitates in the street and popularly small, but their high sumbors help grantures exposure of adequare blocket to feeding fishes in the circum

Manuscount alternatives. Those Crock to Mill a high quility fairly entque squaric system, at least for Stab. There are edges of a downward trend to weber quality as a results of healty downstice exacting.

reason wouth should be prevented. The manufact values and water above the reason wouth should be prevented. The manufact values a sub whiter but love are equative actually execute to extrative a diverse equatic constitution of the constitution of the entering errors canning a reductive fit the diversity and love and density of the entering companies.

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could have dreatly affects. Ermowel of streets de vegetarion can
couse extreme water teacherature increases from uncontrolled solar
restation and allow series hash exected and entress charmed address.

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The two extremes in alternatives would be to either write
Thoms Creek off and allow unlimited grazing or to completely remove
domestic animals from the area adjoining the stream. Neither of
these alternatives is practical or desirable. The actual management
may have to be a compromise between one of the extreme alternatives
and the optimal; but as far as possible, streamside vegetation should
be protected. Aerial infrared photography should aid in determining
the width of riparian zones to be protected and the extent of future
changes in such.

The creek of and alternatives would be to aither will's chowseric animals from the area adjoining the errans of the completely redove these alternatives is practical or desirable. The octual concessors and the optimal but as possible, electrical observation at the compression of the electrical and the optimal but as possible, electrical desirable of the electrical and the protected. Actial interest abords, alternative and the entered of the electrical observations and the entered of factors and the entered of factors.

Table 16. Stream habitat survey summary and analysis for Thoms Creek on 1 July 1975.

1.	State, County 2.	District		3. Resource AreaP.U.	
	Utah, Juab	Salt Lake		House RangeFish	Springs
4.	Drainage 5.	Stream Unit		6. Location	
	Thoms Creek	Thoms Creek		T. 11S R. 18W Sec	t. 16-17
7.	Investigators			8. Date	
	Winget, Heckmann, and Reicher	t		July 1, 1975	
	General Data		Prior	tity A Limiting Factors	
9.	Total length of stream (mi.)	≃25	25. Percent in pool	of total stream width	37%
10.	Total length of stream		26. Pool-ri	ffle ratio, % optimum	74
	surveyed (mi.)	2			
	a. BLM b. Public	distribution of the same of th	27. Pool qu	ality, % optimum	67
	c. Private			of stream bottom sirable materials	83
11.	Total No. sample stations:		29. Percent	spawning gravels	56
	a. BLM	3		over, % optimum	
	b. Public				90
	c. Private	district.	31. Bank st	ability, % optimum	99
12.	Total of all stream width		32. Percent	of habitat optimum	83
12.	measurements (ft.)	114			
			Prior	ity B Limiting Factors	
13.	Total channel width (ft.)	203	33. Average	depth of stream (ft.)	0.8
14.	Total widthall pools (ft.)	42		width of stream (ft.)	9.5
1.5	m. v. 1 / 1.1 . C - 11 1 -				
15.	Total width of all pools classed 1, 2, and 3 (ft.)	38		width of channel (ft.)	16.9
	classed 1, 2, and 3 (10.)			of bottom with	1
16.	Total footage of desirable		clingin	g vegetation (ft.)	<u>~1</u>
	bottom materials (ft.)	95		of bottom with	
17.	Total spawning gravels (ft.)	65	rooted	vegetation (ft.)	
1/.	local spawning gravers (it.)		38. Percent	stream shade	84%
18.	Sum of cover ratings	86	39. Average	stream gradient (%)	7
19.	Sum of stability ratings	95	40. Average	stream velocity (f/s)	2.0
17.	Sum of Stability fatings	-	41. Stream	discharge (cfs)	9.4
20.	Elevation: (MSL)	1 32 22		AND ASSESSMENT OF THE PARTY OF	
	a. Lowest	7,400	42. Average	e water temperature:	8° C
	b. Highest	8,800	1		
21	Multiple was gones remate		43. Average	Air Temperature	19° C
21.	Multiple use zones remote recreation		* * * * * * * * * * * * * * * * * * * *		
	range use		44. Turbidi	ty description (clear)	O JTU
			45. Access		
22.	Number of camera points	≃9		Remote	1
23.	Total cost			ow standard trails	1
43.	a. Planning			low standard roads	10
	b. Salaries			Improved roads	
	c. Equipment			The state of the s	
	d. Analysis of data			quality analysis: Hach kit (pH, Turb. CO,,	DO)
10				Chemical (BYU) (Merritt)	X
24.	Cost per station			Coli (Bionics)	
				(22011268)	

Table 16. Street ballost mayer sometry and assignts for Thomas Creek on 1 July 1975.

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	Percent of avenue bottom			
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Table 17. Stream habitat survey summary and analysis for Thoms Creek on 27 September 1975.

1.	State, County	2. District		3. Resource AreaP.U	
	Utah, Juab	Salt Lake			
4.	Drainage Thoms Creek	5. Stream Unit Thoms Creek		6. Location T. 11S R. 18W Se	ct. 16-17
7.	Investigators Winget, Heckmann, and Reic	hert	T part of	8. Date 27 September 1975	
	General Data	100		Priority A Limiting Factors	76 9
9.	Total length of stream (mi	.) ≃25	25.		
10.	Total length of stream	2 2 222		in pools	36%
10.	surveyed (mi.)		26.	Pool-riffle ratio, % optimum	72
	a. BLM	2	27.	Pool quality, % optimum	67
	b. Public		28.		-07
	c. Private	-	20.	Percent of stream bottom with desirable materials	70
11.	Total No. sample stations:	Indanien.	29.	Percent spawning gravels	33
	a. BLM b. Public	3	30.	Bank cover, % optimum	87.5
	c. Private		31.	Bank stability, % optimum	88
		***************************************			
12.	Total of all stream width		32.	Percent of habitat optimum	77
	measurements (ft.)	110			
13.	Total channel width (ft.)	169	4	Priority B Limiting Factors	
	(227)	103	33.	Average depth of stream (ft.)	0.22
14.	Total widthall pools (ft.	) 40	34.	Average width of stream (ft.)	7.3
15.	Total width of all pools		35.	Average width of channel (ft.)	11.3
	classed 1, 2, and 3 (ft.)		36.		11.3
16.	Total footage of desirable		30.	Percent of bottom with clinging vegetation (ft.)	<1%
	bottom materials (ft.)		37.	Percent of bottom with	
17.	. Total spawning gravels (ft.	) 36		rooted vegetation (ft.)	<1
18.		7-27-	38.	Percent stream shade	85
10.	Sum of cover ratings	105	39.	Average stream gradient (%)	6.9
19.	Sum of stability ratings	106	40.	Average stream velocity (f/s)	1.45
20.	Elevation: (MSL)		41.	Stream discharge (cfs) (at S-3)	1.28
	a. Lowest	7,400	42.	Average water temperature:	
	b. Highest	8,800		(°F or °C)	8° C
01	W.1		43.	Average Air Temperature	11.5
21.	Multiple use zones remote			(°F or °C)	24° C
	recreati range us		44.	Turbidity description (clear)	O JTU
	zambe do		45.	Access (mi.):	
22.	Number of camera points	_≃9		a. Remote	
22	M-4-3			b. Low standard trails	1
23.	Total cost a. Planning			c. Improved trails	
	b. Salaries	-		<ul><li>d. Low standard roads</li><li>e. Improved roads</li></ul>	10
	c. Equipment	-			
1,11	d. Analysis of data		46.	Water quality analysis:  a. Hach kit	
24	Cook now should			a. Hach kit b. Chemical (BYU)	X
24.	Cost per station			c. Coli (BYU)	X

Table 17. Street habital staves without analysis for Thomas.

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Table 18. Water quality analysis of Thoms Creek.

	or orcharge booter studies to Libon	1 July	y 1975	27 Sep	tember 1975
Analys	sis* Test	S-1	S-3	· S-1	S-3
	Time	1030	1530	1050	1310
1	Alkalinity, total as CaCO <sub>3</sub> , mg/1 Bicarbonate as HCO <sub>3</sub> , mg/1	29	19	18	31
1, 6	Bicarbonate as HCO2, mg/1	35	23	21	38
1	boton as B, µg/1		14	1,150	1,700
1	Calcium as Ca, mg/1	6	. 5	5	11
1	Carbonate as CO <sub>3</sub> , mg/1 Chloride as Cl, 3mg/1	<0.1	<0.1	<0.1	<0.1
1	Chloride as Cl, 3mg/1	. 1	1	1	1
1	Conductivity, µmhos/cm (25° C)	46.3	54.6	57.6	93.3
1	Hardness as $CaCO_3$ , $mg/1$ Hydroxide as $OH, \frac{3}{mg}/1$	34	42	17	33
1	Hydroxide as OH, 3mg/1	<0.1	<0.1	<0.1	<0.1
1	Magnesium as Mg, mg/1	5	7	1	1
1	pH	7.7	7.6	6.8	8
1	Potassium as K, mg/1	0.5	0.5	0.4	
1	Sodium as Na, mg/1	2.6	3.3	3.3	0.5
1	Sulfate as SO, mg/1	6	6	1	4
1	Sulfate as SO <sub>4</sub> , mg/l Total Dissolved Solids	44	52	43	1
3	Turbidity, JTU's	0	0		72
3	Dissolved Oxygen as O2, mg/1	8		0	0
1	Nitrate as N, mg/l	0.27	0.49	0.03	0.04
1	Phosphate (Total) as P, mg/1	0.008	0.017		0.04
1	Phosphate (ortho) as P, mg/1	<0.001	0.017	0.008	0.004
3	Air Temperature, °C	18	20	19	26
3	Water Temperature, °C	6	9	6	9
4, 1	Total Coliform, MPN/100 ml Fecal Coliform, MPN/100 ml	86	138	210 210	210 23

<sup>\*1.</sup> BYU Environmental Analysis Laboratories

<sup>2.</sup> USGS

<sup>3.</sup> Field determinations

<sup>4.</sup> Bionics

Utah Department of Health and Welfare
 Ford Laboratory, Salt Lake City

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Table 19. Statistics for stepwise pooled samples for Thoms Creek Site S-3 on 1 July 1975 and 27 September 1975.

Step*	Total No. of Taxa	Mean No/ft <sup>2</sup>	80% Confidence Limits LL	80% Confidence Limits UL	Standard Deviation	Percent SE of Mean	Coefficient of Variation	ΙÐ	Н
1 July 1975									
1	18	undefined	undefined	undefined	undefined	undefined	undefined	2.34	2.22
2	25	341.5	198.4	484.6	65.8	13.6	19.3	2.38	2.28
3	29	480.0	213.9	746.1	244.4	29.4	50.9	2.59	2.53
27 September 1975									
11 mly 1975	26	undefined	undefined	undefined	undefined	undefined	undefined	3.31	3.28
2	30	3,798.0	1,489.5	6,106.5	1,060.7	19.8	27.9	3.44	3.41
3	33	3,561.3	2,630.6	4,492.0	854.7	13.9	24.0	3.37	3.34

<sup>\*</sup>Step 1 consists of only one sample; Step 2 is the results from 2 pooled samples; Step 3 is the results from 3 pooled samples, etc.

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Dale of the second					Confidence Limits
					Confinence Links
		0.086			
500			(%)		

Table 20. Summary of macroinvertebrate community analysis for Thoms Creek on 1 July 1975 and 27 September 1975.

Sampling Site	Number of Taxa	Total $ar{ exttt{X}}$ number/m	% Ephemeroptera	% Plecoptera	% Trichoptera	% Coleoptera	% Diptera	% Other Invertebrates	ויס	н
S-1	Sant.	h wented.	E	100						
1 July 1975	29	9,845	11	9	1	0	67	12	2.21	2.14
27 September 1975	28	19,992	21	37	7	0	15	20	3.58	3.53
S-2										
1 July 1975	26	4,272	34	5	3	0	44	14	2.90	2.76
27 September 1975	36	29,924	24	24	7	0.1	30	15	3.75	3.71
S-3										
1 July 1975	26	5,143	21	4	1	0	63	10	2.59	2.53
27 September 1975	33	38,413	40	39	0.4	0	15	5	3.37	3.34

					E Trichopters
				· Company	ATTACK OF LONG

Table 21. Number per meter square of macroinvertebrate taxa collected from Thoms Creek.

					-	1975
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Taxa	S-1	S-2	S-3	S-1	S-2	S-3
Phylum Platyhelminthes						794
Class Turbellaria						
Order Tricladia (Planaria)	86	75	0	968	742	32
Phylum Aschelminthes						
Class Nematoda	129	11	32	0	65	129
Phylum Mollusca						
Class Pelecypoda .	11	0	0	0	0	ō
Phylum Annelida						
Class Oligochaeta	549	258	183	1,528	301	689
Phylum Arthropoda						
Class Arachnida						
Order Acarina						
Suborder Hydracarina	409	269	301	1,420	3,271	1,173
Class Crustacea				100		
Order Ostracoda	86	0	22	344	893	291
Order Copepoda	22	0	140	0	183	118
Class Insecta				6,000	636	
Order Collembola	0	11	0	0	0	0
Family Entomobryidae	0	0	11	161	732	0
Family Smynthuridae	0	0	32	0	0	0
Order Ephemeroptera						
Family Siphlonuridae	20				1423	1 20
Ameletus sp. Family Baetidae	32	0	0	11	54	21
Baetis spp.	581	909	100	005		
Family Heptageniidae	201	909	420	925	4,562	7,607
Cinygmula sp.	301	291	161	2,550	1,022	0
Epeorus sp.	21	108	183			1,614
Epeorus deceptivus	0	0	0	0 22	0	0
Epeorus longimanus	0	0	0	54	118	
Family Leptophlebiidae	•		U	34	110	1,108
Paraleptophlebia sp.	43	43	118	182	850	3,508
Family Ephemerellidae			110	102	050	3,300
Ephemerella spp.	11	0	118	161	204	495
Ephemerella doddsi	0	0	54	387	355	1.098
Ephemerella coloradensis	11	11	32	0	0	0
Other Ephemeroptera	65	11	11	0	0	0
Topic Com Apr A	13	- 11	-	0		

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Table 21. (continued).

		1 July 1975			27 September 1975		
Taxa	S-1	S-2	S-3	S-1	S-2	s-	
Order Plecoptera							
Family Nemouridae							
Malenka californica	0	0	0	A	0		
Zapada sp.	140	32	75				
Zapada cintipes	0	0	0	65	1,668	58:	
Other Nemouridae	0	0	0	0	1,334	1	
Family Capniidae	603	86	54	3,013	2,421	4 22	
Family Taeniopterygidae			34	3,013	2,421	4,11	
Taenionema nigripennis	0	- A	0	11	22	9,78	
Family Leuctridae	0	0	0	2,087	1,011		
Family Pteronarcidae				2,007	1,011		
Pteronarcys princeps	0	0	0	0	0	5	
Family Perlodidae				Ť.,	0	,	
Megarcys signata	0	0	0	22	32		
Other Perlodidae	86	65	0	0	0		
Family Chloroperlidae					•		
Paraperla frontalis	O	11	0	0	0	. 1	
Other Chloroperlidae	11	0	22	108	86	20	
Family Perlidae			11/11/11	200	00	20	
Hesperoperla pacifica	0	0	0	0	0	9	
Other Plecoptera	22	0	32	2,055	656	3	
Order Trichoptera				-,055	030	1	
Family Rhyacophilidae							
Rhyacophila sp.	108	108	22	1,356	1,162	54	
Family Glossosomatidae				2,330	1,102	٠,	
Agapetus sp.	33	11	22	75	108	65	
Family Philopotamidae	D	0	0	0	172	11	
Family Limnephilidae							
Oligophlebodes sp.	0	11	0	0	0	(	
Other Limnephilidae	0	11	11	22.	603	1	
Family Brachycentridae							
Brachycentrus sp.	0	0	11	0	0	11	
Order Lepidoptera	11	0	0	0	0	(	
Order Hymenoptera	0	0	0	11	11	ò	
Order Coleoptera							
Family Elmidae	0	0	ō	0	22	11	
Order Diptera				-		**	
Family Tipulidae							
Antocha monticola	0	0	0	0	11	0	
Dicranota sp.	32	11	11	32	43	75	
Hexatoma sp.	0	0	0	0	0	11	
Tipulidae sp. A	0	0	0	0	11	11	
Other Tipulidae	11	11	22	22	0	0	
Family Psychodidae	0	0	0	32	280	1,313	
Family Dixidae				-		-, 323	
Dixa sp.	21	22	0	11	118	- 0	
Family Simuliidae	21	32	32	54	829	829	
Family Chironomidae	6,402	1,710	3,088	2,765	7,413	3,486	
Family Ceratopogonidae	21	11	43	0	11	43	
Family Empididae	43	32	32	54	247	161	
Other Diptera	32	43	54	. 0	32	0	

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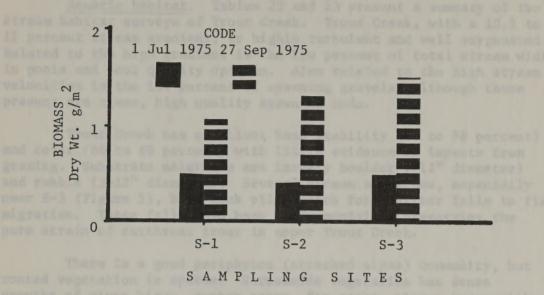
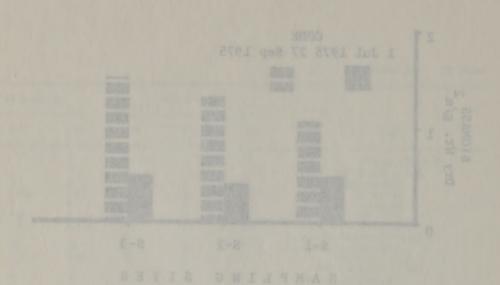


Figure 9. Comparison of macroinvertebrate standing crop (biomass) at three sites on Thoms Creek on 1 July 1975 and 27 September 1975.



etcoding eroy (siomets) at three eites on Thoma Creek on Limby 1915 and 27 Septechen 1975

## Trout Creek

Plates X to XII contain photographs of stream conditions existing during this survey.

Aquatic habitat. Tables 22 and 23 present a summary of two stream habitat surveys of Trout Creek. Trout Creek, with a 10.5 to 11 percent stream gradient, is highly turbulent and well oxygenated. Related to the high gradient is the low percent of total stream width in pools and pool quality optimum. Also related to the high stream velocities is the low percent of spawning gravels, although those present are clean, high quality spawning beds.

Trout Creek has excellent bank stability (84 to 88 percent) and cover (86 to 88 percent) with little evidence of impacts from grazing. Substrate materials are largely boulder (>12" diameter) and rubble (3-12" diameter). Several stream stretches, especially near S-3 (Figure 5), have rock piles which form barrier falls to fish migration. These falls have been instrumental in preserving the pure strain of cutthroat trout in upper Trout Creek.

There is a good periphyton (attached algae) community, but rooted vegetation is sparse. Streamside vegetation has dense growths of river birch, quaken aspen, fir trees, pinyon trees with various small shrubs such as mountain mahogany, wild rose, sage, and rabbit brush.

At present the aquatic habitat is good with little evidence of human-use related impacts. The location of a mining claim (Figure 5) on the headwaters of Trout Creek poses a real threat to future aquatic habitat.

Water quality. Table 24 presents a summary of water quality analyses of Trout Creek waters. In general, Trout Creek is a soft water, bicarbonate buffered, highly oxygenated, cold clear mountain stream.

Nutrients are present in low concentrations but high enough to support good periphyton growths and a diverse aquatic community. Nitrogen is seasonal in its concentrations with highs following spring snow melt and lows in late summer through winter. Phosphate levels appear fairly constant with levels low (0.003 to 0.02 mg/1).

Macroinvertebrate community. Table 26 presents a summary of step analysis of pooled samples from S-3 on Trout Creek. With standard errors of the mean only 14.2 on 2 July and 19.7 on 26 September, it can be assumed that adequate samples were taken and the aquatic communities were only moderately clustered in their distribution.

Trout Creek

Places X to XII contain photographs of stress conditions existing during this survey.

Aquatic babicar, Tables 12 and 23 prosent a summary of two stream habitat surveys of front Creek. Trout Creek, with a 10.5 to 11 percent stream gradient, is highly surbulent and well oxymenated. Related to the high gradient is the high stream width in pools and pool quality optimum. Also related to the high stream velocities is the low percent of spawning gravals, slchough these present are closm, high quality upsyming beds.

Trout Creek has excellent bank stability (85 to 88 percent) and cover (85 to 88 percent) with little evidence of impacts from grantne. Substrate materials are largely boulder (>12" diameter) and rubble (3-12" diameter). Several amena stretches, especially. near 5-3 (Figure 5), have ruck piles which form barrier falls to Filth migration. These falls have been fostrawantal in preserving the pure strein of cutthroat trout in upper Trout Greek.

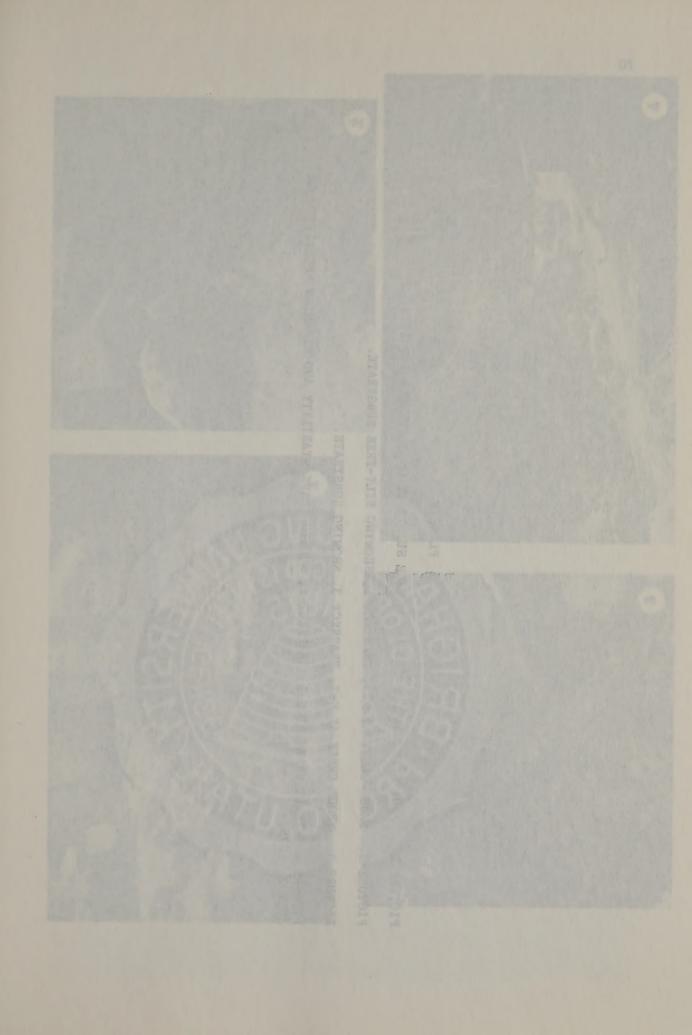
There is a good periphyton (estracted algae) community, but rooted vortestion is sparse. Streamside vegetation has derea growthe of river birch, quaken aspin, fir trees, playen trees with various small shrubs such as munitain metagony, wild rose, sage, and rabbit brush.

At present the aquetto bebies is good with little evidence of human-use related impacts. The incetion of a mining claim (Figure 5) on the headwaters of Trout Greek poses a real circuit toture aquatic habitat.

Water quality. Table 24 presents a summary of value quality analyses of front Creek waters. In general, front Creek is a soft water, bicerbonate buffered, highly oxygenated, cold clear countain stream.

Nutrients are present in low concentrations but high counts to support good periphyton growing and a diverse aquatic community.
Mitrogen is seasonal in the concentrations with highs following epring snow melt and lows in late summer through winter. Phosphate levels appear fairly constant with levels low (0.003 to 0.02 ag/1).

Macroinvertebrate community. Table 25 presents a susmary of step enalysis of pooled samples from S-3 on Troot Creek. With standard errors of the mean only 14.2 on 2 July and 19.7 on 26 September. It can be assumed that edequate samples were taken and the aquatic communities were only moderately clustered in their distribution.



## PLATE X

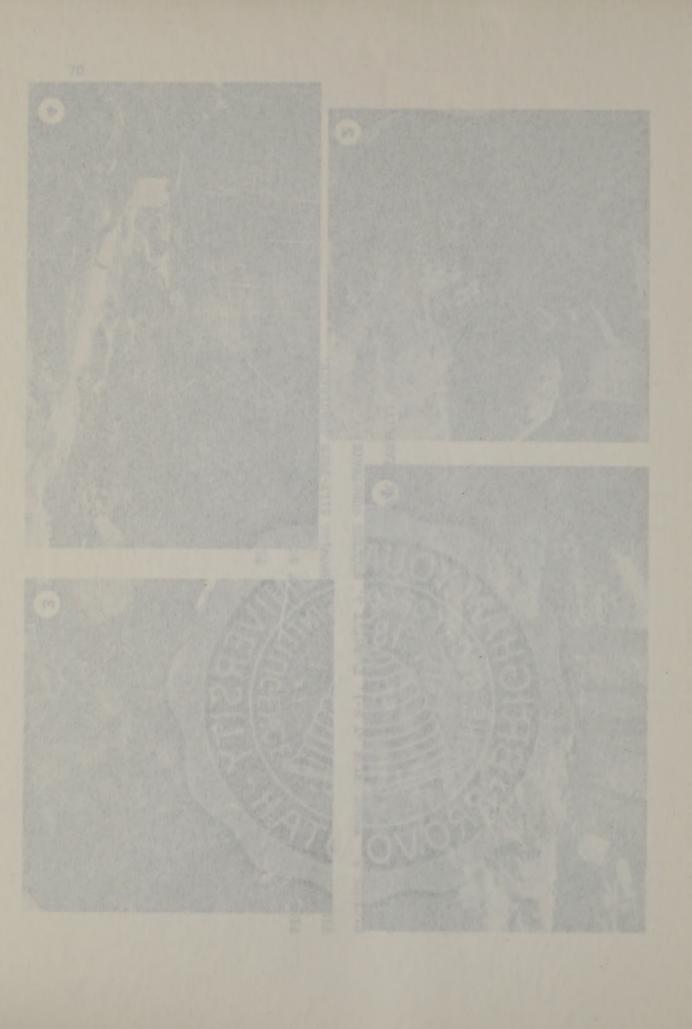
- PICTURE 1. TROUT CREEK AT S-2 SHOWING RUBBLE SUBSTRATE ON SEPTEMBER 26, 1975.
- PICTURE 2. TROUT CREEK AT S-2, TRANSECT 1, SHOWING SILT-FREE SUBSTRATE.
- PICTURE 3. TROUT CREEK AT S-1, TRANSECT 3, SHOWING SUBSTRATE.
- PICTURE 4. TROUT CREEK AT S-1, TRANSECT 1, SHOWING BANK STABILITY AND RIPARIAN VEGETATION ON JULY 2, 1975.

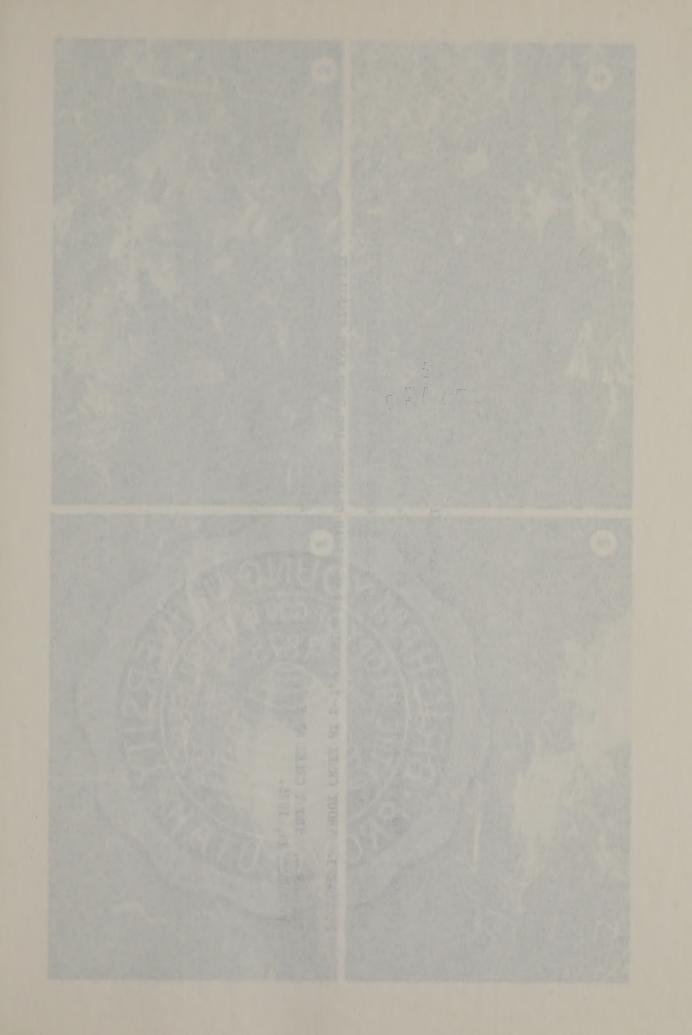






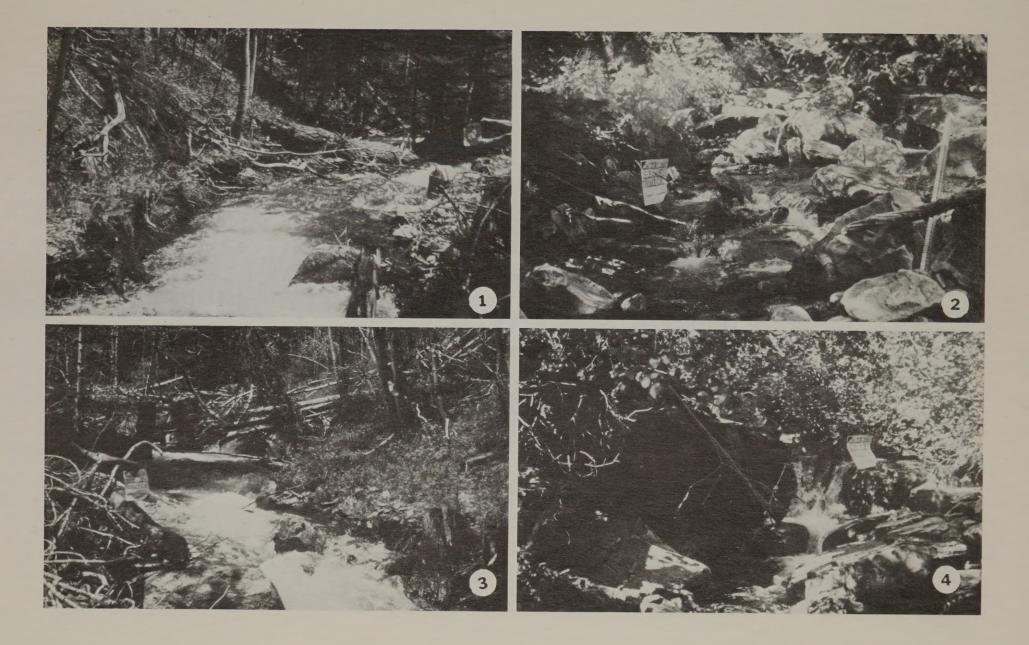


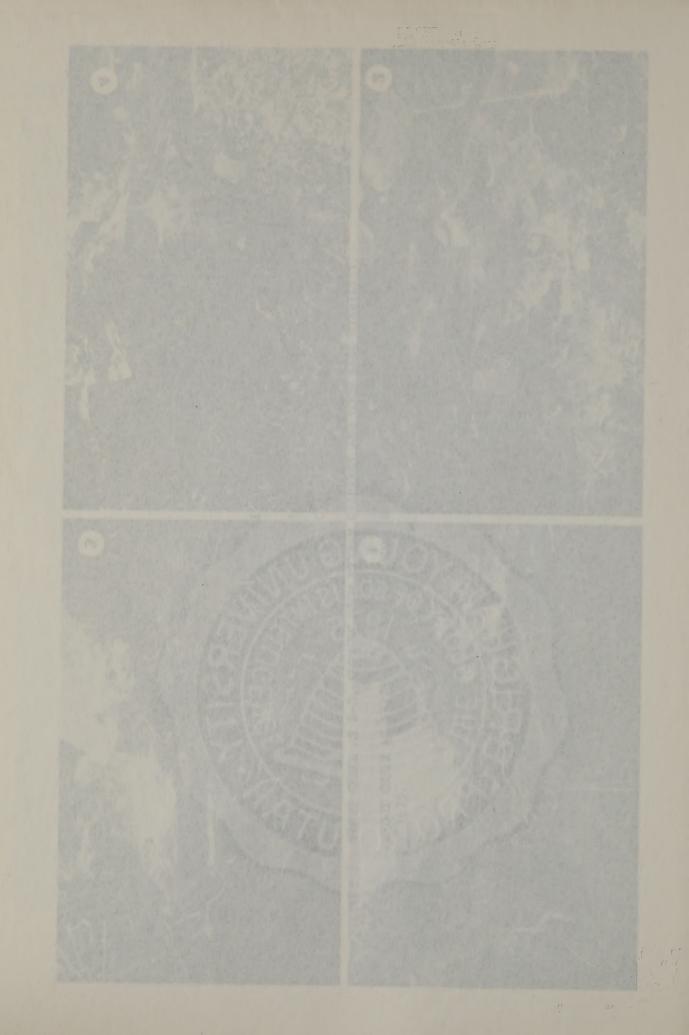




## PLATE XI

- PICTURE 1. TROUT CREEK AT S-2, TRANSECT 3 ON JULY 2, 1975.
- PICTURE 2. TROUT CREEK AT S-3, TRANSECT 5, SHOWING GOOD COVER AND STABILITY ON SEPTEMBER 26, 1975.
- PICTURE 3. TROUT CREEK AT S-3, SHOWING HIGH STREAM GRADIENT AND GOOD BANK STABILITY.
- PICTURE 4. TROUT CREEK AT S-3, TRANSECT 3, SHOWING ABUNDANT COVER AND STABILITY ON SEPTEMBER 26, 1975.

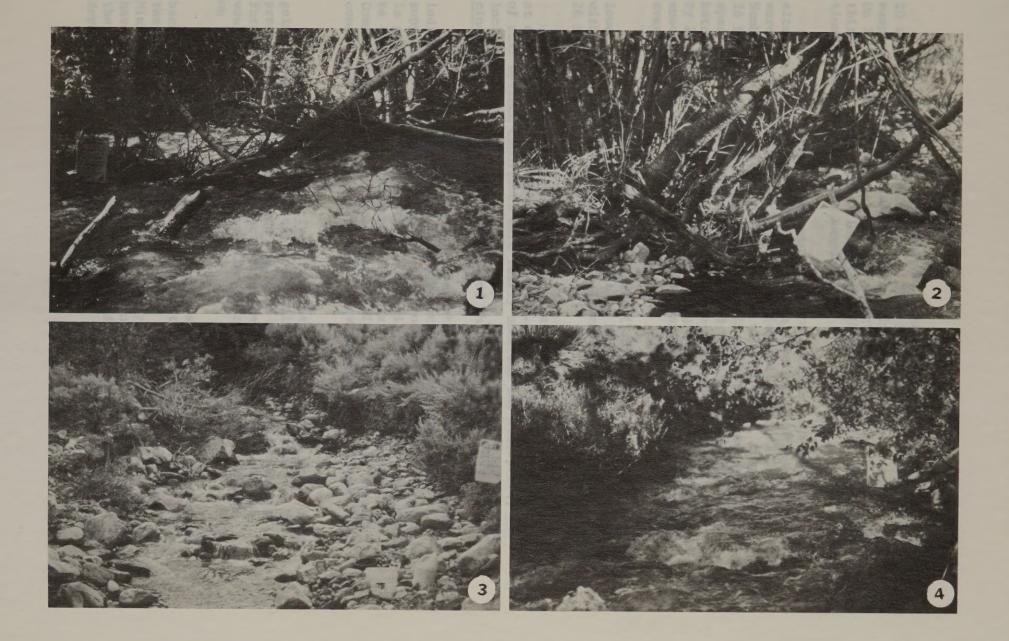






## PLATE XII

- PICTURE 1. TROUT CREEK DURING HIGH RUNOFF AT S-4, TRANSECT 1, ON JULY 1, 1975.
- PICTURE 2. TROUT CREEK AT S-4, TRANSECT 1, ON SEPTEMBER 26, 1975, SHOWING ABUNDANT RIPARIAN VEGETATION.
- PICTURE 3. TROUT CREEK AT S-5, TRANSECT 1, NEAR GAUGING STATION, SHOWING DESERT TYPE RIPARIAN VEGETATION.
- PICTURE 4. TROUT CREEK AT S-5, TRANSECT 1, ON JULY 2, 1975, SHOWING HIGH RUNOFF.





On 2 July 1975 the number of taxa sampled increased from 20 in two samples to 23 in three. This indicates that additional samples would probably have included additional taxa not sampled. On 26 September there was only one additional taxa collected in the third sample, indicating a low probability of collecting many additional taxa by taking more samples.

Table 27 gives a summary of macroinvertebrate samples at all sites on both sampling dates. Dominance\_diversity indices (d and H) were high with a range of 2.70 to 3.41 (d) and 2.64 to 3.32 (H). Number of taxa was lower on 2 July 1975 with 15 to 23, than on 26 September 1975 with 28 to 33. This is to be expected as many species would have emerged by 2 July and their eggs would not have hatched or young instars would have been too small to identify. By 26 September many young of the spring emergers would have acquired enough summer growth to allow identification to family or perhaps even genus.

Total numbers per meter square (Table 27) were considerably lower on 2 July, perhaps as a result of high spring runoff coupled with spring emergence. Numbers had increased substantially by 26 September.

Table 28 contains a list of taxa collected and their numbers at each site for the two sampling dates. Several species indicative of near optimum conditions were fairly numerous and widespread, including: the mayflies Cinygmula sp., Epeorus deceptivus, Epeorus cinctipes, Capniidae, Leuctridae, and Chloroperlidae.

In general, the macroinvertebrate samples from Trout Creek indicate a healthy, diverse, and productive community capable of supporting a fisheries of native cutthroat trout. Biomass (Figure 10) is good for a soft-water stream but still low enough that care should be taken to preserve the macroinvertebrate diversity and abundance. Communities of macroinvertebrates in soft waters are often fragile communities with marked responses to environmental perturbations.

Management alternatives. Impacts to Trout Creek are probably going to be limited to mining, road building, and grazing. At the present, the greatest concern should be mining and road building. Further increases of man's activities on the fragile environment would cause significant degradation of critical aquatic habitats on the mountain.

It is imperative that Trout Creek be protected from siltation because with the high water velocities there would be severe scouring, the sediments acting as grinding powder on the aquatic organisms. Mine wastes, including overburden, heavy metals, acids, etc. would have the immediate effects of eliminating several taxa and reducing the density of others. Other taxa would show varied responses, depending upon the type and severity of perturbation. In order for

On 2 July 1975 the names of care sampled increased from 20 in two samples to 23 in three. This indicates that additional case not sampled on 26 September there was only one additional case not sampled the the third sample, indicating as low probability of collected in the tional case by casing nore samples.

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Total numbers per merer square (Table 27) were considerably lower on 2 July, perhaps as a result of high spring runoff coupled with apring emergence. Numbers had increased substantially by

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In general, the wantedwortebrote samples from Trout Croth indicate a healthy, diverse, and productive community capable of supporting a fisheries of pative cutthreet trout, sieness (Firers 10) is good for a molt-vater stream but still low enough that earn should be taken to preserve the macroirvariabrate directly and abondance. Communities of macroidvartebrates in soft waters are often fregile communities with marked responses to extropuental parturbations.

Monagament alternatives imparts to Trous Liest are wrotelly.

going to be limited to mining, mod unifolding, and grading. At the

present, the greatest compare obsole be mining and and building.

Further increases of manin activities on the Fruitle securiosis.

would cause significant telescoped of cratical observate politics.

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effective energy flow from terrestrial and aquatic plants to invertebrates and finally to the cutthroat trout, a good diverse community of macroinvertebrates needs to be preserved.

Trout Creek is a unique desert-mountain stream with unique aquatic communities and as such should have strict management controls insuring maintenance of quality aquatic habitat. The streamside vegetation is possibly the most important factor in controlling quality stream habitat, thus there should be a buffer zone of several hundred feet undisturbed between any development and Trout Creek.

Because of the primitive and unique characteristics of Trout Creek, there should be only one management choice with no alternatives, and that is to preserve the existing stream quality and conditions. This includes preventing any stream channelization, diversion of waters above the canyon mouth, clearing of streamside vegetation, or any other activity which will cause pollution of the aquatic environment.

Continued evaluation surveys are necessary to provide the baseline for evaluating effectiveness of management procedures and impacts of resource development. Water quality and macroinvertebrate samples should be taken on a regular basis with periodic bacterial analyses. Infrared color aerial photographs would aid in measuring riparian plant community changes—information necessary in determining width of riparian vegetation buffer zones along the stream.

effective energy flow from nerrosirial and aquatic plants to invertebrates and finally to the cutthrost trout, a good diverse community of magnifebrates prede to be preserved.

Trout Creek is a majora desert-wounding attemm eld continuity aquatic communities and as such should have still compared continuity insuring maintenance of quality appearance of quality should be a buffer tone of saveral quality errors routed between any development and Trout Creek.

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Continued evaluating effectiveness of management procedures and impacts of resource development. Merer quality and narrolaverter brate emples should be taken on a regular hasha with periodic becoming analyses. Infrared color serial photographs would sid be amagerial plant companity charges—information necessary in determining width of riperian vegetation buffer somes along the attract.

Table 22. Stream habitat survey summary and analysis for Trout Creek on 2 July 1975.

1.	State, County 2.	District			3. Resource AreaP.U.	
	Utah, Juab	Salt Lake			House RangeFish	Spring
4.	Drainage 5.	Stream Unit			6. Location	A
	Trout Creek	Trout Creek			T. 12S R. 18W Sec	t. 33
7.	Investigators Winget, Heckmann, and Reicher	-			8. Date July 2, 1975	
		-		D-d		/.
	General Data			Prior	ity A Limiting Factors	
9.	Total length of stream (mi.)	<u>~20</u>	25.	Percent in pools	of total stream width s	20%
10.	Total length of stream surveyed (mi.)		26.	Pool-ri	ffle ratio, % optimum	40
	a. BLM	4.5	27.	Pool qua	ality, % optimum	36
	b. Public		28.	Percent	of stream bottom	
	c. Private	-	20.		sirable materials	80
11.	Total No. sample stations:		29.	Percent	spawning gravels	28
	a. BLM b. Public	5	30.	Bank co	ver, % optimum	88
	c. Private		31.	Bank sta	ability, % optimum	88
			32.		of habitat optimum	66
12.	Total of all stream width	207	22.	rerectie	or habited operada.	
	measurements (ft.)	309		Prior	ity B Limiting Factors	
13.	Total channel width (ft.)	470				
	L. Toronto and Common Company of		33.	Average	depth of stream (ft.)	0.6
14.	Total widthall pools (ft.)	62	34.	Average	width of stream (ft.)	15
15.	Total width of all pools		35.	Average	width of channel (ft.)	22.4
	classed 1, 2, and 3 (ft.)	56	36.	Percent	3%	
16.	Total footage of desirable bottom materials (ft.)	246	37.		of bottom with	
	bottom materials (10.)	240	37.		vegetation (ft.)	2%
17.	Total spawning gravels (ft.)	88	38.	Percent	stream shade	82
18.	Sum of cover ratings	147	39.	Average	stream gradient (%)	11
10	Com of stability potions	1/0	40.	Average	stream velocity (f/s)	3.0
19.	Sum of stability ratings	148	41.	Stream	discharge (cfs)	33
20.	Elevation: (MSL)		42.		near USGS gauging stn) water temperature:	
	a. Lowest	6,500	44.	(°F or		8° C
	b. Highest	9,000	43.	Avorage	Air Temperature	
21.	Multiple use zones remote	<u> </u>	431	(°F or		19.5°C
	recreation		44.	Turbidi	ty description	O JTU
	rangemin	ing	45.	Access		
22.	Number of camera points	215	73.		emote	
					ow standard trails	2
23.	Total cost				mproved trails	2
	a. Planning				ow standard roads mproved roads	4
	b. Salaries			e. 1	mproved roads	
	<ul><li>c. Equipment</li><li>d. Analysis of data</li></ul>		46.	Water q	uality analysis:	1.1.1.
	d. Maryors of data	-		a. H	ach kit (pH, CO <sub>2</sub> , DO, To	rbidity
24.	Cost per station				hemical (BYU)	X
				c. C	oli (Bionics)	X

Table 22. Stream habitant survey summary and sanitysis for Tront

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nercens of total stress width			Lagrin Lagrin
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Percent speeding gravels . 22			
mank cover, 2 cyclasse . 88			
start stability, 2 optiming			
Percent of babicat opplers			
Priority & Limiting Factors			
Ath (-21) exerce to drups eganous			
A.CT (.tt) Immed to dable exercis			
(cor promise that the core			
TIL D dorsolated displayer .			
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referience validation waste			
E Caskocke , seed as			

Table 23. Stream habitat survey summary and analysis for Trout Creek on 26 September 1975.

1.	State, County 2	District		3. Res	ource AreaP.U.	
	Utah, Juab	Salt Lake		House	RangeFish	Spring
4.	Drainage 5	. Stream Unit		6. Loc		
٠.	Trout Creek	Trout Creek		T.	12S R. 18W Sect	. 33
7.	Investigators			8. Dat	e	
10	Winget, Heckmann, and Reiche	rt		26	September 1975	
	General Data			Priority A Li	miting Factors	
9.	Total length of stream (mi.)	<u>≃20</u>	25.	Percent of tota in pools	l stream width	32
0.	Total length of stream		26	Pool-riffle rat	do 9 optimum	64
	surveyed (mi.)		26.			
	a. BLM.	4.5	27.	Pool quality, %	optimum	58
	b. Public c. Private		28.	Percent of stre		
	c. Private			with desirable	materials	52
1.	Total No. sample stations:		29.	Percent spawnin	g gravels	19
	a. BLM	5	30.	Bank cover, % o	ptimum	86
	b. Public		31.	Bank stability,	7 ontimum	84
	c. Private					
2.	Total of all stream width		32.	Percent of habi	tat optimum	69
	measurements (ft.)	282				
				Priority B Li	miting Factors	
3.	Total channel width (ft.)	487	33.	Average depth of	of stream (ft.)	0.34
4.	Total widthall pools (ft.)	91	101			11.3
	10002 0000		34.	Average width o		
5.	Total width of all pools	0.2	35.	Average width o	of channel (ft.)	19.5
	classed 1, 2, and 3 (ft.)	83	36.	Percent of bott clinging vegeta		1%
6.	Total footage of desirable	1/6	27			
	bottom materials (ft.)	146	37.	Percent of bott		<1
7.	Total spawning gravels (ft.)	54	38.	Percent stream		64
				11 11	F F	10.5
8.	Sum of cover ratings	171	39.	Average stream	gradient (%)	
9.	Sum of stability ratings	168	40.	Average stream	velocity (f/s)	1.61
			41.	Stream discharg		4.54
0.	Elevation: (MSL)	6 500	42.	(at Site S-5) Average water	emperature:	
	a. Lowest	6,500 9,000	726	(°F or °C)	2011	8.6°C
	b. Highest	3,000	43.	Average Air Ter	mperature	
1.	Multiple use zones remote		-	(°F or °C)		18° C
	recreatio	n	44.	Turbidity desci	ription (clear)	O JTU
	range and	mining				
2	Wlan of severe points	≃15	45.	Access (mi.): a. Remote		
2.	Number of camera points				dard trails	2
3.	Total cost			c. Improved		2
	a. Planning				dard roads	2
	b. Salaries			e. Improved	roads	
	c. Equipment		46.	Water quality	analysis:	
	d. Analysis of data			a. Hach kit	(nave)	
24.	Cost per station			b. Chemical		X
				c. Coli (BY	0)	X

Table 23. Strene habitet survey summary and analysis for Troat Creek on 26 September 1975-

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		tremme of rotel arrow which	The second	
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Table 24. Water quality analysis of Trout Creek.

		2 July	1975	26	September 19	975
Analysis* by	Test	S-1	S-5	S-1	S-4	S-5
	Time	1130	1800	1130	1600	1735
1	Alkalinity, total as CaCO, mg/1	16		12	20	21
1	Alkalinity, total as CaCO <sub>3</sub> , mg/1 Bicarbonate as HCO <sub>3</sub> , mg/1	20		. 14	24	26
6	Boron as B, µg/1 3.			1,100	1,650	1,660
1	Calcium as Ca, mg/l	5		6	8	8
1	Carbonate as CO <sub>3</sub> , mg/1	<0.1		<0.1	<0.1	<0.1
1	Chloride as Cl, mg/1	2		1	2	2
1	Conductivity, µmhos/cm (25° C)	44.1	-	58.8	. 67.6	74.1
1	Hardness as CaCO3, mg/1	34		19	25	28
1	Hydroxide as OH, mg/1	<0.1		<0.1	<0.1	<0.1
1	Magnesium as Mg, mg/1	5		1	1	2
1	pH	7.6	7.2	6.3	6.8	6.8
1	Potassium as K, mg/1	0.5		0.5	0.6	0.7
1	Sodium as Na, mg/1	2.3		2.6	2.9	3.4
1	Sulfate as SO <sub>4</sub> , mg/1	9.0		5	6	. 8
1	Total Dissolved Solids	42	-	41	46	54
3	Turbidity, JTU's	0	0	0	0	0
3	Dissolved Oxygen as O2, mg/l		9	9		
1	Nitrate as N, mg/1	0.23		0.04	0.03	0.03
1	Phosphate (Total) as P, mg/1	0.003				0.03
1	Phosphate (ortho) as P, mg/1	<0.001		0.016	0.009	0.007
3	Air Temperature, °C	19	18	18	19	
3	Water Temperature, °C	6	10	7.5	10	***
4, 1	Total Coliform, MPN/100 ml	14		-	20	43
4, 1	Fecal Coliform, MPN/100 ml	3			<3	<3

\*1. BYU Environmental Analysis Laboratories

2. USGS

3. Field determinations

4. Bionics

5. Utah Department of Health and Welfare

6. Ford Laboratory, Salt Lake City

	estrocated electron interest total tra			

Cr in

Table 25. Trout Creek water temperature data--daily minimum and maximum temperatures (°C) for July 4 to August 4, 1975.

Date		Min	Max		Date	Min	Max
July	4	6.5	9.0		July 21	8.5	10.5
	5	7.0	9.5		22	8.5	10.5
	6	7.5	9.0		23	9.0	10.5
	7	7.5	10.0		24	9.5	10.0
	8	8.0	10.5		25	9.5	10.5
	9	8.5	10.0		26	9.5	11.0
	10	8.5	9.5		27	9.5	10.5
	11	8.5	9.5		28	10.0	11.0
	12	8.0	9.0		29	10.5	11.0
	13	8.5	10.0		30	10.0	11.0
1	14	8.5	10.5		31	9.0	9.5
	15	8.5	10.0		Aug. 1	8.5	10.0
	16	8.5	9.0		2	9.0	10.5
	17	8.0	9.0		3	9.0	10.5
	18	8.5	10.0		4	9.0	11.0
	19	8.5	10.0				
	20	8.0	10.0				
15-da mea	~	8.	9		15-day mean		9.9

Table 25. Trout Creek water temperature data-daily minimum and maximum temperatures (°C) for July 4 to August 4, 1975.

	818	
10.0		
	0.0	

Table 26. Statistics for stepwise pooled samples for Trout Creek Site S-3 on 2 July 1975 and 26 September 1975.

Step*	Total No. of Taxa	Mean No/ft <sup>2</sup>	80% Confidence Limits LL	80% Confidence Limits UL	Standard Deviation	Percent SE of Mean	Coefficient of Variation	סיו	н
2 July 1975									
1	12	undefined	undefined	undefined	undefined	undefined	undefined	2.48	2.39
2	20	464.5	195.2	733.8	123.7	18.8	26.6	2.71	2.65
3	23	430.3	315.3	545.4	105.6	14.2	24.6	2.70	2.64
26 September 1975									
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	25	undefined	undefined	undefined	undefined	undefined	undefined	2.78	2.76
2	28	3,424.5	588.1	6,260.9	1,303.2	26.9	38.1	2.88	2.86
3	29	3,117.3	1,958.7	4,276.0	1,064.1	19.7	34.1	2.98	2.96

\*Step 1 consists of only one sample; Step 2 is the results from 2 pooled samples; Step 3 is the results from 3 pooled samples, etc.

	F				E canderd Deviation	
newstant				The state of the s	Controcace b	
The second second second second second	Č.	A. 657 17.60			Contidence b	

Table 27. Summary of macroinvertebrate community analysis for Trout Creek on 2 July 1975 and 26 September 1975.

								tes		
Sampling Site	Number of Taxa	Total $ar{ ilde{x}}$ Number $/_{ exttt{m}}^2$	% Ephemeroptera	% Plecoptera	% Trichoptera	% Coleoptera	% Diptera	% Other Invertebrat	סיו	Ħ
S-1	territo ter		198 392	181				A.194. Allah		
2 July 1975	18	4,939	53	14	3	0	20	10	3.00	2.90
26 September 1975 S-2	28	18,260	19	47	5	0.5	16	11	3.37	3.32
2 July 1975	15	2,744	53	10	5	0	23	9	3.09	2.94
26 September 1975	29	29,482	15	54	5	0.1	20	8	2.97	2.93
S-3										
2 July 1975	23	4,670	45	7	3	0.5	40	5	2.70	2.64
26 September 1975 S-4	29	33,611	21	55	2	0.8	12	10	2.98	2.96
2 July 1975	20	5,993	38	12	1	1	40	8	2.93	2.83
26 September 1975 S-5	28	20,638	42	39	1	2	7	8	3.12	3.08
2 July 1975	21	4,401	30	11	3	18	29	9	3.41	3.28
26 September 1975	33	34,819	70	7	1	2	10	9	2.78	2.74

		Z Other Invertebrates
N-00		
		Total X Number/m <sup>2</sup>

Table 28. Number per meter square of macroinvertebrate taxa collected from Trout Creek.

		:	2 July 19	75			26	September	1975	
Taxa	S-1	S-2	S-3	S-4	S-5	S-1	S-2	S-3	S-4	S-5
Phylum Platyhelminthes		34		and a		1			201	710
Class Turbellaria		31	9	9			3			
Order Tricladia (Planaria)	0	54	0	0	0	1,001	538	54	43	11
Phylum Aschelminthes	•	_								
Class Nematoda Phylum Annelida	0	0	11	0	0	22	32	32	86	43
Class Oligochaeta	0	0	11	43	0	54	54	65	32	248
Phylum Arthropoda	0	U	11	43	U	54	24	0.5	32	240
Class Arachnida										
Order Acarina										
Suborder Hydracarina	484	248	226	420	420	2,034	2,399	3,303	1,603	2,765
Class Crustacea						-,	-,0,7	0,500	110	-,
Order Ostracoda	43	11	11	11	0	32	32	0	43	22
Order Copepoda	0	0	0	0	0	0	11	11	0	0
Class Insecta										
Order Collembola	11	0	0	0	0	0	0	0	0	0
Family Entomobryidae	0	0	0	0	0	86	97	0	0	0
Family Smynthuridae	0	0	11	0	0	0	0	0	0	0
Order Ephemeroptera										
Family Siphlonuridae										
Ameletus sp.	0	0	0	0	0	0	0	11	11	(
Family Baetidae										
Baetis sp.	538	291	161	237	409	1,345	1,172	3,185	6,166	17,657
Family Heptageniidae						-,				
Cinygmula sp.	667	699	560	667	452	710	1,313	1,130	753	2,787
Epeorus sp.	1,334	441	1,270	1,086	280	0	0	0	0	(
Epeorus deceptivus	0	0	0	-0	0	301	236	182	75	(
Epeorus longimanus	0	0	0	0	0	538	1,291	1,808	1,269	3,195
Other Heptageniidae	53	0	0	0	0	11	86	291	0	(
Family Leptophlebiidae	0									
Paraleptophlebia sp.	0	0	11	215	97	0	0	54	139	688
Family Ephemerellidae										
Ephemerella sp.	0	0	32	0	75	0	0	43	0	11
Ephemerella doddsi	0	22	32	32	11	613	344	291	334	226
Ephemerella coloradensis		0	0	11	0	0	11	0	0	(
Other Ephemeroptera	11	0	32	65	0	0	11	0	0	(
Order Plecoptera										
Family Nemouridae	0	0	0	0	0	-			,	
Malenka californica	0	-	0	0	0	A	A	A	A	A
Zapada sp.	172	86	43	43	108	22	97	129	11	(
Zapada cinctipes	0	0	0	0	0	32	43	0 A	43	8
Zapada haysi						A				
Other Nemouridae	0	0	0	0	0	732	1,313	2,593	1,636	75
Family Capitidae	0	_	201							
<u>Capnia</u> sp. Other Capniidae	0	0	204	54	0	0	0	0	0	(
Family Taeniopterygidae	0	0	_	-	11	904	473	75	22	54
Family Leuctridae	0	0	0	0	0	5,520	12,073	14,246	22	1,022
Family Pteronarcidae	0	U	U	U	0	904	1,205	785	420	269
Pteronarcys princeps	0	0	0	0	43	0	0	0	0	11
Family Perlodidae		U	o o	0	43	0	U	0	U	11
Megarcys signata	0	0	0	0	0	11	11	0	0	C
Other Perlodidae	11	ő	ő	ő	22	0	0	0	0	Č

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			2 July 197	5			26 5	September	1975	
Taxa	S-1	S-2	S-3	S-4	S-5	S-1	S-2	S-3	S-4	s-
Family Chloroperlidae	11	86	32	527	237	161	129	226	301	5
Sweltsa coloradensis	0	A	0	0	0	0	0	0	0	
Triznaka pintada Fumily Perlidae	0	0	0	0	0	A	0	0	0	
Hesperoperla pacifica	11	43	32	108	65	355	452	495	301	2
Other Plecoptera	495	86	11	0	0	0	0	0	22	
Order Trichoptera										
Family Rhyacophilidae				8 277.00						
Rhyacophila sp. Family Glossosomatidae	118	129	86	43	65	796	872	236	65	]
Agapetus sp.	11	0	11	0	0	11	0	11	0	
Family Philopotamidae	0	0	0	0	0	108	65	280	215	
Family Hydropsychidae										
Hydropsyche sp.	0	0	0	0	54	0	0	0	0	
Arctopsyche sp.	0	0	.0	0	11	0	0	0	32	
Family Limnephilidae	0	0	0	0	0	- 11	0	0	11	
Family Brachycentridae			20							
Brachycentrus sp.	0	0	32	0	0	0	0	0	0	
Micrasema sp. Order Hymenoptera	22	0	0	0	0	0	0	0	0	
Suborder Chalcidoidea	0	0	0.	0	0	0	0	0 11	0	
Suborder Ichneumonoidea	U	. 0	0	U	U	U	0	11	0	
Family Braconidae	0	0	0	0	0	0	0	-11	0	
Order Coleoptera	0	0	U	0		U	U	11	U	
Family Elmidae	0	0	22	43	775	86	22	258	463	
Optionervus sp.				73	,,,		24	230	403	
Family Chrysomelidae	0	0	32	0	. 0	0	0	0	0	
Family Curculionidae	0	0	0	11	0	0	0	0	0	
Order Diptera										
Family Tipulidae										
Antocha monticola	0	0	0	11	0	0	0	11	11	
Dicranota sp.	0	0	11	0	0	11	32	22	0	
Hexatoma sp.	0	0	0	. 0	0	11	0	0	0	
Other Tipulidae	0	0	0	0	0	0	11	0	0	
Family Tanyderidae	0	0	0	0	0	0	0	0	. 0	
Family Psychodidae	0	0	0	22	11	0	0	0	194	4
Family Dixidae	200									
Dixa sp.	11	11	0	0	0	43	32	22	0	
Family Simuliidae	43	54	32	0	194	22	108	97	0	1
Simulium sp.	0	0	0	0	0	0	0	0	11	
Family Chironomidae	904	527	1,743	2,259	1,054	2,873	5,477	3,368	1,216	2,
Family Ceratopogonidae Family Stratiomyidae	0	0	11	0	0	0	0	22	0	2
Family Stratiomyldae Family Tabanidae	0	0	0	0	0	0	11	0	0	
Family Empididae	22	11	65	75	0	43	139	377		
Other Diptera	43	43	0	32	11				43	
Other Diptera	43	43	0	32	11	0	0	0	0	

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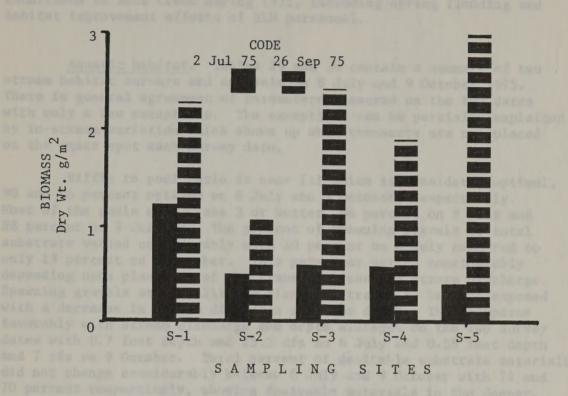


Figure 10. Comparison of macroinvertebrate standing crop (biomass) at five sites on Trout Creek on 2 July 1975 and 26 September 1975.

Figure 10. Comparison of marcinvertabrata standing crop (biomens) at five sites on Trout Treek on I July 1979 and 26 September 1973.

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# Stream Under Recreational Impact Analysis

#### Rock Creek

Plates XIII to XV show existing stream habitat plus varying conditions in Rock Creek during 1975, including spring flooding and habitat improvement efforts of BLM personnel.

Aquatic habitat. Tables 29 and 30 contain a summary of two stream habitat surveys and analysis on 8 July and 9 October 1975. There is general agreement of parameters measured on the two dates with only a few exceptions. The exceptions can be partially explained by in-stream variation which shows up when transects are not placed on the exact spot each survey date.

Riffle to pool ratio is near 1:1 which is considered optimal, 90 and 96 percent optimum on 8 July and 9 October, respectively. Most of the pools were Class 3 or better, 64 percent on 8 July and 88 percent on 9 October. The percent of spawning gravels to total substrate varied considerably with 50 percent on 8 July compared to only 19 percent on 9 October. This parameter varies considerably depending upon placement of the transect lines and stream discharge. Spawning gravels are usually the first substrates to be left exposed with a decrease in stream discharge and thus depth. This compares favorably with stream discharge and depth averages on the two survey dates with 0.7 feet depth and 15.3 cfs on 8 July and 0.58 feet depth and 7 cfs on 9 October. Total percent of desirable substrate materials did not change considerably between 8 July and 9 October with 74 and 70 percent respectively, showing desirable materials in the deeper, faster areas remained covered while the spawning beds were partially exposed during periods of low flow.

Rock Creek is largely of optimum habitat overall with 71 and 79 percent on 8 July and 9 October, respectively; but there are areas with serious habitat problems. Near the mouth where Rock Creek enters the Green River, there are numerous areas of unstable banks and habitat degradation.

Past agricultural uses of the area have resulted in the near complete removal of all native streamside vegetation except for an occasional juniper or cottonwood tree. The willows, birch, and other brush, tall weeds, and grasses are extremely sparse. The dominant vegetation is the seasonal June grass which adds almost nothing to the stability of the stream banks. With the low annual rainfall of this desert region and the poor, sandy soil, it will take a long time for the plant communities to become reestablished, if ever.

In summary, stream habitat quality is limited mainly by bank erosion and lack of deep pools with good cover.

SOCK Creek

Places NIII to XV show existing stream habitat plus varying conditions in Rock Creek during 1975, including spring flooding and habitat improvement effects of Bill personnel.

Aquatic habites, vables 29 and 30 consula a summary of two street habites curveys and analysis on 8 haly end 9 october 1975.

There is general egreeness of parameters measured on the two datas with only a few exceptions. The exceptions can be partially explained by in-except exceptions up when transects are not placed on the exact spot each curvey date.

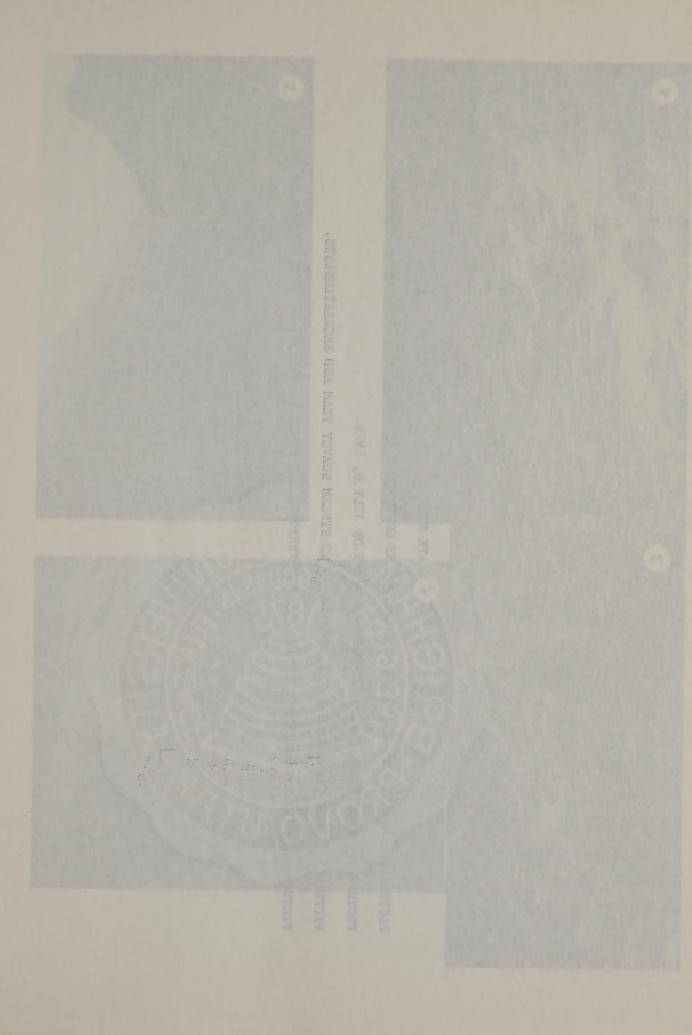
eiffie to pool retto to meat it which is considered optimal, and 96 percent optimal on 8 July and 9 October, respectively.

Most of the pools were Class 3 or better, 66 percent on 8 July and 68 percent on 9 October, The percent of Spanning gravels to total substrate varied considerably with 50 percent on 8 July conferred to only 19 percent on 9 October. This percent varies considerably sign percent of the transmit inces and stress discharge spanning gravels are usually the first substrates to be left exposed favorably with a decrease in stress discharge and thus depth. This compared favorably with stress discharge and thus depth. This compared dates with 0.7 feet depth and ii.3 rfs on 8 July and 0.58 feet depth and 7 ofs on 9 October. Total purcent of desirable substrate material did not chasse considerably between 8 July and 9 October with 74 and did not chasse considerably between 8 July and 9 October with 74 and find not chasse considerably between 8 July and 9 October with 74 and find not chasse considerably between 8 July and 9 October with 74 and find not chasse considerably between 8 July and 9 October with 74 and find not chasse considerably between 8 July and 9 October with 74 and find not chasse remained covered while the spanning buds were partially exposed during periods of jow flow.

Rock Greek is largely of optimum habitat owntail with 72 204 79 percent on 8 July and 9 October, respectively; but there are arons with serious habitat problems. Near the south where Nock Greek enters the Greek Hiver, there are numerous areas of unstable banks and habitat degradation.

Past serical wat uses of the area have resulted in the next complete removal of all native streemelds veneral to except for an eccasional jumiper or cottonwood true the willows, birch, and other brush, call weeds, and graces are extremely spares. The dominant vegetation is the seasonal lume grace which adia almost nothing to the stability of the streem banks. With the low ansual rainfall of this desert region and the poor, sandy soil, it will take a long time for the plant communities to become recentablished, if ever.

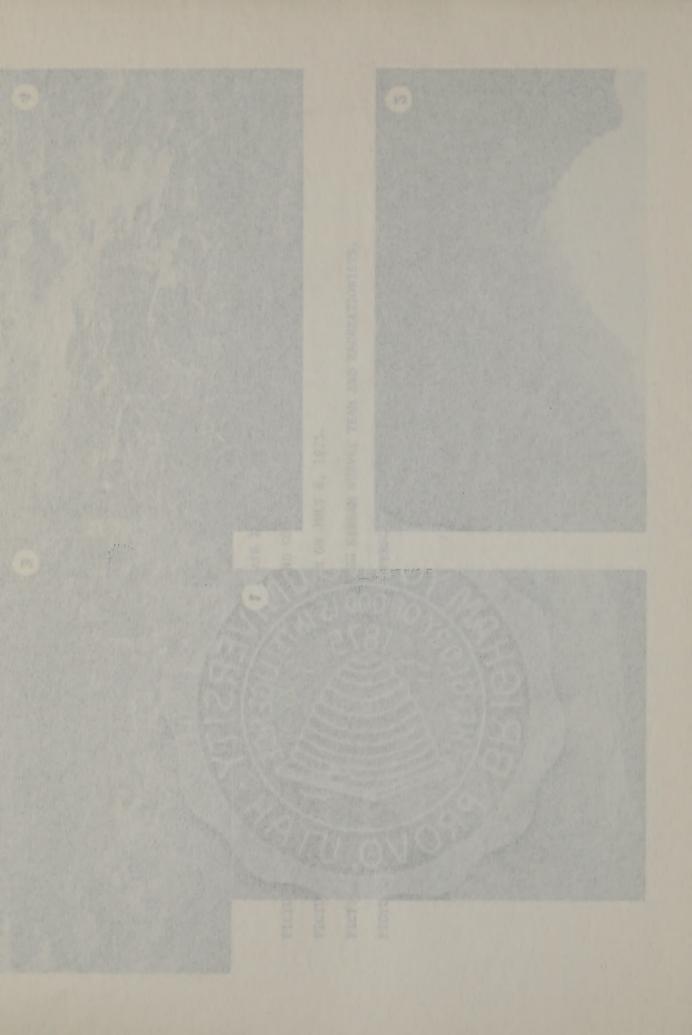
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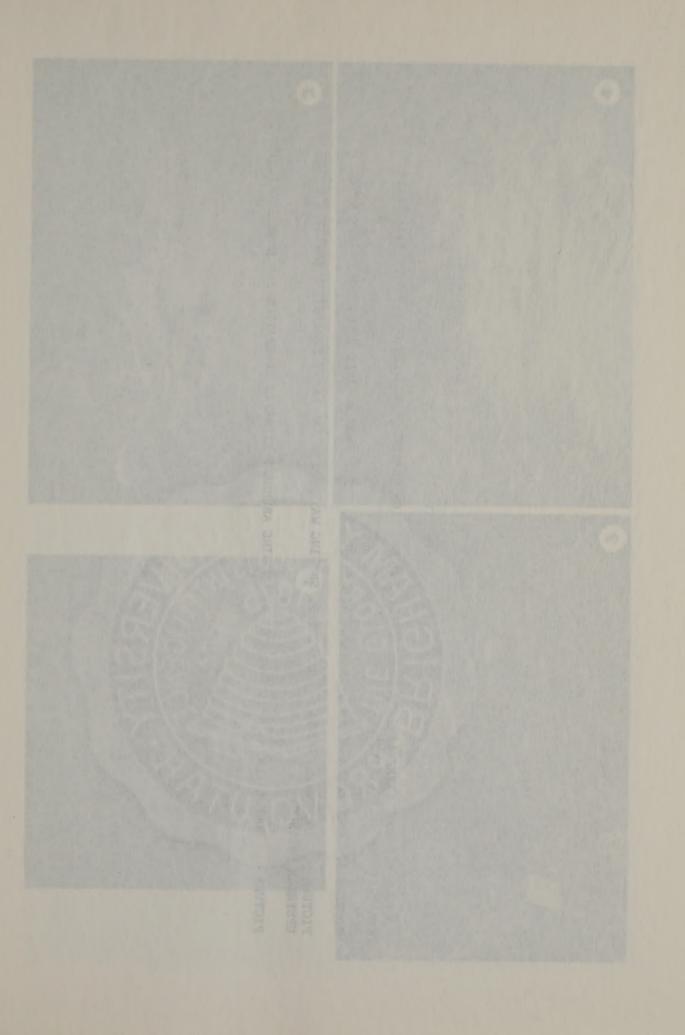


### PLATE XIII

- PICTURE 1. AERIAL VIEW OF ROCK CREEK CANYON AND CONFLUENCE WITH THE GREEN RIVER ON JULY 7, 1975.
- PICTURE 2. ROCK CREEK CANYON DURING RAINSHOWER ON JULY 8, 1975.
- PICTURE 3. ROCK CREEK AT S-1 NEAR MOUTH SHOWING STREAM SURVEY TEAM AND RECREATIONISTS.
- PICTURE 4. STREAM IMPROVEMENT PROJECT BY BLM PERSONNEL IN LOWER WASHED OUT REACHES OF ROCK CREEK.



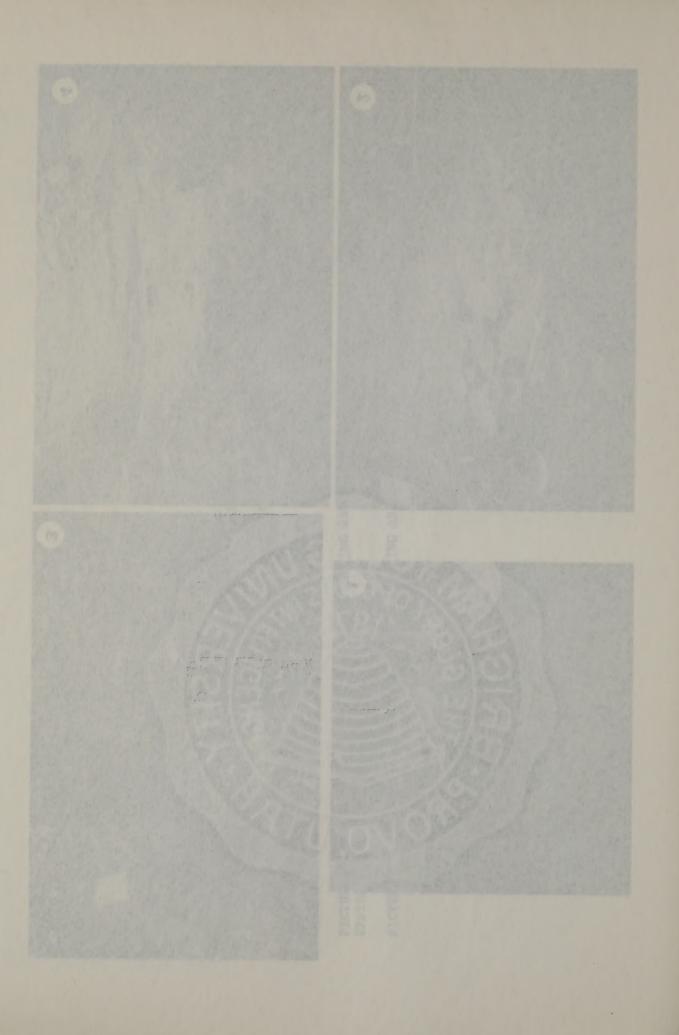


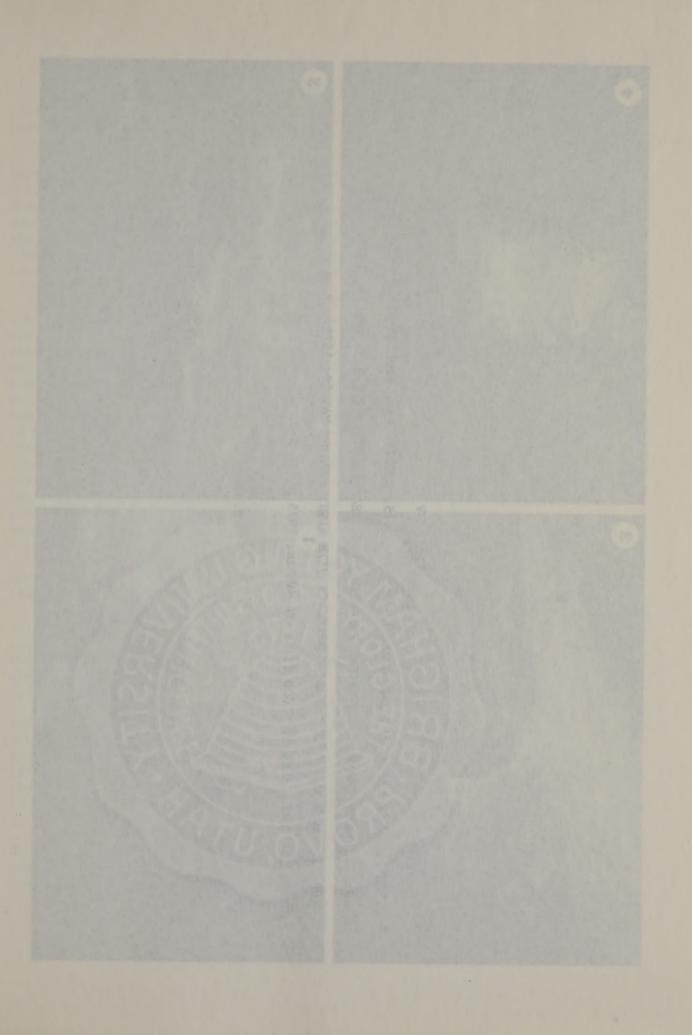


### PLATE XIV

- PICTURE 1. ROCK CREEK AT S-3, TRANSECT 1, SHOWING HIGH QUALITY POOL WITH GOOD COVER AND STABLE SUBSTRATE ON JULY 8, 1975.
- PICTURE 2. ROCK CREEK AT S-2, TRANSECT 4, ON JULY 8, 1975, SHOWING FAIR COVER AND STABLE BANKS.
- PICTURE 3. ROCK CREEK AT S-3, TRANSECT 5, SHOWING WATERCRESS AND HEAVY PERIPHYTON GROWTH DUE TO UPSTREAM SPRINGS.
- PICTURE 4. ROCK CREEK AT S-3, TRANSECT 4, SHOWING ABUNDANT RIPARIAN VEGETATION AND BANK STABILITY.

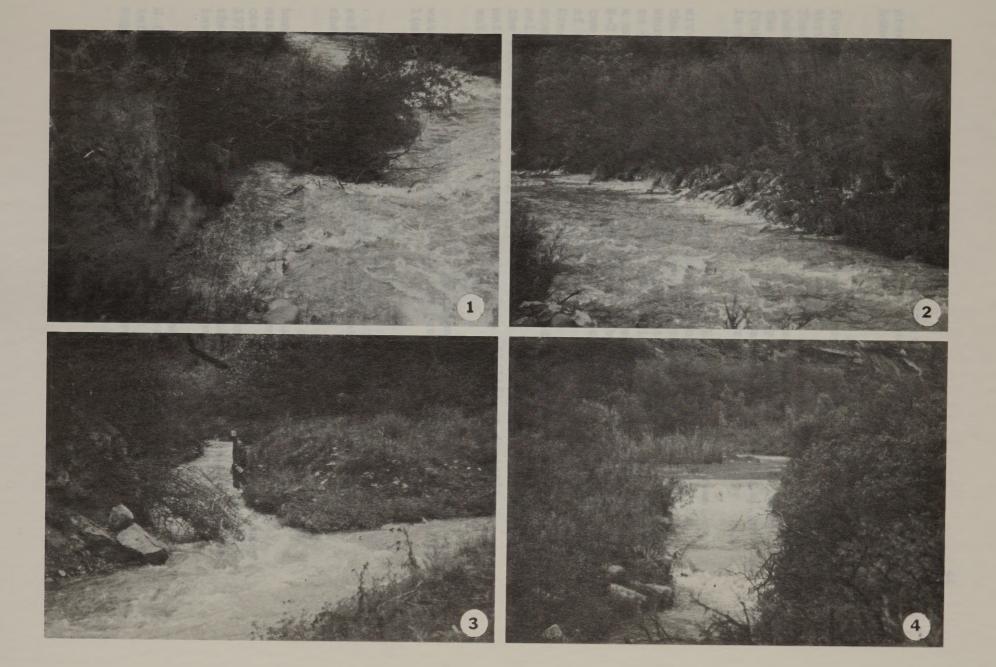


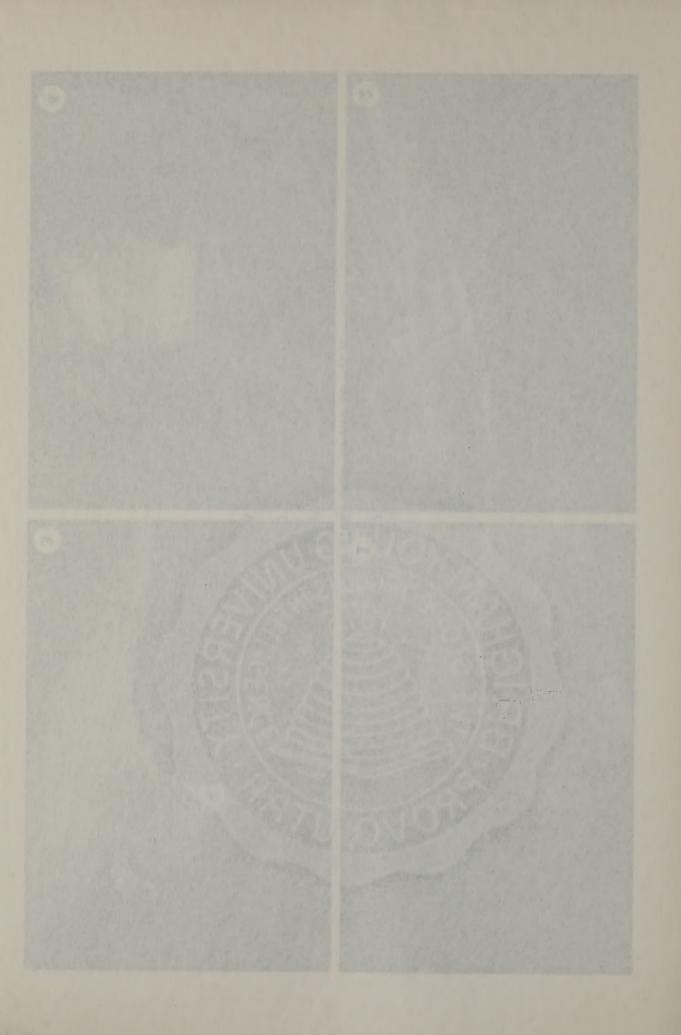




## PLATE XV

- PICTURE 1. ROCK CREEK IN FLOOD STAGE ON MAY 28, 1975, SHOWING BANK EROSION BELOW S-3.
- PICTURE 2. ROCK CREEK FLOOD WATERS RETURNING TO STREAM BELOW SITE S-3 ON MAY 28, 1975.
- PICTURE 3. ROCK CREEK LEFT FORK CONFLUENCE WITH RIGHT FORK ON MAY 28, 1975.
- PICTURE 4. ROCK CREEK AT FLOOD STAGE ON MAY 28, 1975 ABOVE S-2.





Water quality. According to the water quality analyses presented in Table 31, Rock Creek is a moderately hard water, bicarbonate buffered, cold water stream.

Along the perennial stream reach in the Rock Creek drainage from the forks 2 miles upstream dense growths of deciduous trees and shrubs occur with resultant heavy winter leaf packs on the ground. These leaves decompose during the winter and the nitrates and phosphates produced are leached into the stream during runoff. This explains the higher nitrate nitrogen levels in May as compared to October (Table 31). It appears that the main limiting factor to algal growths is the near absence of available phosphorus.

Bacterial samples from Rock Creek on 8 July 1975 reveal an erratic distribution of total coliform and fecal streptococci in the stream course (Table 31). Apparently there were some point sources of bacteria with 2,100/100 ml total coliform from S-2 compared to 410 and 700 from S-1 and S-3, respectively. Fecal coliform followed a more expected distribution with 7/100 ml at S-1 and 40/100 ml at S-2 and S-3. Bacterial samples have to be kept in cold storage for two to three days before they can be processed, thus the reliability of these sample data is low. It appears evident, though, that Rock Creek generally has bacteria levels well within the Utah Class CC standards of a monthly mean not to exceed 5,000/100 ml of total coliforms. Levels do indicate that care should be taken when using the waters for drinking purposes. There evidently are upstream natural sources of bacteria, either from wildlife or domestic animals.

Overall water quality is excellent for maintaining a coldwater fisheries. Nutrient levels are probably the main water quality limiting factor.

Macroinvertebrate communities. The macroinvertebrates reflect the instability in Rock Creek better than the physical-chemical surveys.

Table 35 represents the statistical analysis of reliability of benthic sampling in Rock Creek. This analysis was run for one station only as the same methods were used at all sites. With a coefficient of variation of only 20.9 on 9 July and 23.5 on 8 October 1975, the data is reliable with only a small variance. This means the estimate of the population mean is close to the real mean and the invertebrates are only moderately clustered in their distribution.

The two diversity indices, d (Shannon and Weaver, 1963) and H (Wilhm, 1968) are both dominance diversity indices based upon the information theory which, in summary is: if total numbers of organisms are evenly distributed over several species, the information

Presented in Table 31, Rock Creek is a moderately hard water, plantbonate buffered, cold water are received.

Along the percential strong reach in the Bork Creak draining from the Forks of the strong and decay winter leaf posts on the strongs.

These leaves decompose during the winter and the mitraces and phose phases procuded are insocial into the eleven during runoff. Into explains the migher mirrors alreaded into the strengt always as compared to decober the migher birrors that the strengt and are the phose of applied the course of applied the course of applied the course of applied the course of applied the phose of applied the course of applied th

Escherial samples from Rock Creek on 8 July 1975 reveal as create distribution of total coliform and feesh etraptocoect in the stream course (Table 13). Apparently there were some point accurate of bacteria with 2,100/100 ml total coliform from 5-2 compared to 410 and 700 from 5-1 and 5-3, respectively. Tetal coliform followed a more expected distribution with 7/100 ml at 5-1 and 40/100 ml at 5-2 and 5-3. Hanterial samples have to be kept in cold storage for two to three days before they can be processed, thus the reliability of these mample date is low. It appears evident, though, that field of these generally has bacteria levels well within the Utah Class OC storal coliforms. Is wouthly mean out as exceed 5,000/100 ml of total coliforms. Is worthly mean out as exceed 5,000/100 ml of total coliforms. Is worthly mean out as exceed 5,000/100 ml of total coliforms. Is water and that care should be taken when using astures sources of bacteria, either firm wildlife or demontate animals.

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Mecvoloverrebusts communities. The macron structuals reflect the instability in Sock Greek better than the physicals chartest surveys

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The two diversity indices, 3 (Shannon and Weaver, 1963) and within 1968) are both dominants diversity indices based upon the information theory which, in company is: if each numbers of presentant are evenly distributed over saveral species, the information

gained by studying additional specimens is greatest because the chance of one specimen being different from the preceding one is greatest; and conversely, when the number of organisms is dominated by one or two species, the information gained by studying additional specimens is least because the chance of one specimen being different from the preceding one is least.

A  $\overline{d}$  or H value below 2.0 is poor compared to an optimal cold-water trout stream; but values from 1.0 to 2.0 are not uncommon in desert streams, especially those subject to periodic extremes in flow from storm runoff highs to winter and drought lows. Rock Creek shows evidence of periodic high flows with accompanying scouring and bank erosion.

The macroinvertebrate community at S-1 had lower dominance by any one order than S-2 or S-3 on both collection dates (Table 36). This is significant in assessing environmental quality for the three stations. Numbers of organisms per meter square at S-1 were consistently lower than at S-2 or S-3 but  $\overline{d}$  and H were higher (Table 36). This indicates that S-1 is subjected to stresses which are largely non-selective for any certain species, but rather, affect nearly all species. Physical stress from fluctuating flows, bank erosion, scouring, and siltation fall under that category.

The macroinvertebrate community at S-1 owes its diversity and relative abundance mainly to a constant replenishing of organisms drifting downstream from upstream communities in the more stable habitat areas. The three most dominant forms (chironomid midges, simuliid blackflies, and baetid mayflies) (Table 37) are all active drifters and are often the first to repopulate an area following an environmental perturbation.

Another indicator of biotic condition is the available biomass (standing crop) of macroinvertebrates. Figure 11 illustrates the standing crop at the three stations on Rock Creek on 9 July and 8 October 1975. It is obvious that there is a general degradation in available energy for the fisheries of Rock Creek proceeding downstream from the forks. The stream reach from S-2 upstream acts as the "bread basket" for the lower stream areas by producing high numbers and biomass which recharges the lower sections through downstream drift. Springs above S-3 produce dense growths of watercress and attached algal mats which are largely responsible for the high numbers and biomass of the invertebrate communities in this area.

In May, 1975 flows in Rock Creek were near flood stage. This resulted in bank cave-ins along several sections of the stream and a generalized scouring of substrates. Water velocities and depths prevented any sampling but the low d and H values (Table 36) on 9 July 1975 indicate the damage was severe and recovery was slow. The low d and H values were in direct response to the strong dominance by dipterans (chironomid midges and simuliid blackflies) as shown in

gained by acedying additional specimens is greatest because the chance of one specimen being different from the preceding one is greatest; and conversely, wose the number of organisms in deminated by one or two specimes, the information gained by scudying sudditional specimens is least because the chance of one specimen being this least.

A dor a mine below 2.0 is pour compared to an optimal cold-warm moor metal bet refer in to a 2.0 are not uncommend an desert streams, especially those subject to preidte extremes in flow from storm runoit highe to winter and drought love. Rock creek shows evidence of periodic high flows with accompanying scouring and buck erosion.

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The memotavertebrate community as 8-1 ower its diversity and relative abundance mainly to a constant replanishing of organisms drifting democrates from upstream communities in the more stable matrix areas. The three soot deminant forms (chirosomid midgod admitted blackfites, and bactid mayfiles) (Table 37) are all active drifters and are often the first to repopulate an area following the controllowing to

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Table 37. By 8 October 1975,  $\overline{d}$  and H were significantly higher at S-2 and S-3, but about the same at S-1. Baetid mayflies increased in dominance at all stations (Tables 36 and 37).

Table 37 gives the distribution and relative abundance of taxa collected at Rock Creek during 1975. There are several taxa which are indicative only of good clean cold-water stream systems. Of these, the most significant are the stoneflies Claassenia sabulosa, Hesperoperla pacifica, Isoperla ebria, Capniidae, and Zapada sp. Also, the mayflies Cinygmula sp. and Ephemerella doddsi are limited quite narrowly in their environmental tolerances.

Of the caddisflies, Arctopsyche spp. are relatively intolerant to environmental stresses. The other taxa range from moderately intolerant to extremely tolerant to environmental stresses.

This biotic system is highly resilient and can survive considerable environmental stress, but several species are not so resilient and could be lost. The diversity of organisms guarantees a continuation of the systems, but if a preservation of species diversity is the goal, then strict habitat management should be the approach.

Management alternatives. Rock Creek is the prime source of potable water for recreationalists floating down the Green River. It is obvious that the use of the Green River will not diminish; thus, the use of Rock Creek will not diminish.

The impacts on Rock Creek in the past have come mainly from:
(1) agricultural use--grazing and cultivation of crops; (2) erosion of watershed and stream banks following summer storms and winter snow melt; (3) bacterial contamination from domestic animals, wildlife, and human wastes; and (4) pollutants such as soap, toothpaste, food wastes from washing dishes, and detergent from washing clothes and dishes. Crop cultivation has ceased along with most domestic animal grazing, although there are occasional cattle seen in the valley. This discussion is going to deal primarily with recreational use management alternatives.

Some management alternatives for Rock Creek are:

- 1. Do not allow camping, cooking, washing, fishing, or defecation anywhere in a zone enclosing Rock Creek. Maintain Rock Creek as solely a potable water source.
- 2. Do not allow overnight camping at Rock Creek but allow day camps for sight-seeing, hiking, fishing, and limited sanitary duties. Defecation would have to be limited to certain zones with strict enforcement of methods such as depth of hole, handling of paper, etc. Washing of persons, clothes, and dishes would have to be strictly controlled.

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Table 37 gives the distribution and relative chundance of take molected at Rock Creek during 1975. There are several tark which are indicative only of good clean cold-water stress systems. Of these, the woos eightheant are the stonellias Classenia sabulosa. Hesperoperia partities, Isaneria chris. Capatidae, and Tapada op. Also, the moyellias Chrysolla st. and Ephemeralla dodder are indicated quite carrowly in their carrowly in their carrows.

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The impacts on Bock Greek to the past have come mainly from:

(1) systemic west presenting and cultivation of crops; (2) crosted of vectorated and stream backs following stream saturation from densets animals, villdiffe, and because from vesting of the pollutions sate as soap, toothests, food wantes from vesting dishes, and detergent from vesting clothes and dishes. Crop cultivation has caseed along with wost domestic animal greating, although there are successional cattle seas in the velley.

This discussion is going to deal privately with recreational wast management alternatives.

Some management elternatives for Rock Creek ure:

1. Do not allow camping, cooking, washing, 'fishing, or defecation environe in a rose enclosing Rock Creek, Maintain Rock Creek as solely a potable water source.

2. Do not allow overmight camping at Rock treek but allow day camps for alghtreesing, biking, fishing, Mod limited saulting duties. Defecation would have to be limited to certain some will sariet enforcement of sathods duch on depth of bole, handling of parsons, clothes, and dishes would have to be strictly emittedled.

3. A zone of Rock Creek, perhaps the lower 300 feet, could be considered a sink for all recreational impacts and all human activities limited to this section in an effort to contain use in a small section while preserving the larger section upstream. Chemical pit toilets could be installed along with permanent fire pits. This certainly would not add to the "wild river" image, but it might help contain impact to a smaller area while preserving the wild habitat in surrounding areas. This would be a trade-off type of management.

The management choices for Rock Creek do not realistically include elimination of all impacts from recreational use; but rather, are choices as to what level the impacts should be allowed to go. If Green River use keeps increasing, one alternative would be to establish a ranger station at Rock Creek during the peak use periods.

Lower Rock Creek, at present, is of low biological quality and should come under habitat improvement and/or recreational use development, including at least sanitary refuse facilities. The authors of this report recommend allowing use of Rock Creek with permanent facilities provided. Regulations concerning use would have to be clearly defined and presented to all users. Regular inspection of the area, including a ranger residing at Rock Creek during peak-use periods would be desirable. This should allow maximum use of the resource with controlled impact. Regular water chemistry, macroinvertebrate community characteristics, and bacterial determinations should be made.

3. A some of Nork Creok, perhaps the lower 300 feet, could be considered a sink for all recreational impaces and all human serificates limited to calk section in an effort to contain use in a serif section while preserving the larger could negative while preserving the limited olders with permanent five pice. This contain impact to a smaller area while preserving the wild habited in surrounding areas. This would be a trade-off type of management.

The management choices for Lack Cock do not realistically include alimination of all legacus from recrobilonal cas; but realist are choices as to what level the impacts should be allowed to go. If Green Hiver was keeps increasing, one alternative would be to establish a contex station at Bock Creek during the peak nos portods.

Lower Rock Creek, at present, is of low biological quality and should come under hebitat improvement and/or recreational use development, including at least sanitary refuse factilities. The nuthors of this report recommend allowing use of Bock Creek with to be clearly defined and presented to all users. Regular inspection of the area, including a ranger sesting at Nock Creek during peak-use periods would be desirable. This should allow marked use of the macroinvertebrate community characteristics, and becterial determinantions should be made.

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Table 29. Stream habitat survey summary and analysis for Rock Creek on 8 July 1975.

1.	State, County 2.	District		3. Resource AreaP.U. Price River	
4.	Utah, Carbon Drainage 5.	Moab Stream Unit		Range Creek  6. Location	
	Green River	Rock Creek		T. 15S R. 17E Sec	t. 5
7.	Investigators Winget and Reichert			8. Date 8 July 1975	
-	General Data		Prio	rity A Limiting Factors	. /
9.	Total length of stream (mi.)	≃5		t of total stream width	450
10.	Total length of stream		in pool	iffle ratio, % optimum	90
	surveyed (mi.)				
	a. BLM b. Public	4	27. Pool q	uality, % optimum	64
	c. Private			t of stream bottom esirable materials	74
11.	Total No. sample stations:		29. Percent	spawning gravels	50
	a. BLM	3	30. Bank co	over, % optimum	66
	b. Public c. Private	900 mm		tability, % optimum	61
	c. Ilivate	-			
12.	Total of all stream width		32. Percen	t of habitat optimum	71
	measurements (ft.)	159	Prio	rity B Limiting Factors	
13.	Total channel width (ft.)	271	33. Average	e depth of stream (ft.)	0.7
14.	Total widthall pools (ft.)	72		width of stream (ft.)	13
15.	Total width of all pools			e width of channel (ft.)	23
	classed 1, 2, and 3 (ft.)	51	36. Percent	of bottom with	5%
16.	Total footage of desirable	117		ng vegetation (ft.)	3/6
	bottom materials (ft.)	11/		vegetation (ft.)	5%
17.	Total spawning gravels (ft.)	80	38. Percen	stream shade	47
18.	Sum of cover ratings	63	39. Average	e stream gradient (%)	3
19.	Sum of stability ratings	59	40. Average	e stream velocity (f/s)	1.41
			41. Stream	discharge (cfs)	15.3
20.	Elevation: (MSL)  a. Lowest  b. Highest	4,455	42. Average	e water temperature: °C)	14° C
21.			43. Average	Air Temperature	22° C.
21.	Multiple use zones Recreation Water				
	Remote		44. Turbid:	ity description (clear)	0 JTU
22.	Number of camera points		45. Access	(mi.): Remote (Boat, river)	
	·			Low standard trails	4
23.	Total cost			Improved trails	
	a. Planning	-		Low standard roads	
	<ul><li>b. Salaries</li><li>c. Equipment</li></ul>			Improved roads	
	<ul><li>c. Equipment</li><li>d. Analysis of data</li></ul>			quality analysis:	
			a. I	Hach kit (pH, Tur., CO,	DO)
24.	Cost per station	-		Chemical (BYU) 2 Coli (BYU)	
				COLL (BIO)	

Table 19. Street habitat servey summary and analysis for Enck

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Table 30. Stream habitat survey summary and analysis for Rock Creek for 9 October 1975.

1.	State, County	2. District		3. Resource AreaP.U.	
	Utah, Carbon	Moab		Range Creek	
4.	Drainage	5. Stream Unit		6. Location T. 15S R. 17E Sec	t. 5
7.	Green River Investigators	Rock Creek		8. Date	
-	Winget, Duff, and Reichert			9 October 1975	
	General Data			Priority A Limiting Factors	111
9.	Total length of stream (mi.	) <u>≃5</u>	25.	Percent of total stream width in pools	52%
10.	Total length of stream		26.	Pool-riffle ratio, % optimum	96
	surveyed (mi.)		27.		
	a. BLM b. Public	4		Pool quality, % optimum	88
	c. Private	60 ma	28.	Percent of stream bottom with desirable materials	70
11.	Total No. sample stations:		29.	Percent spawning gravels	_19
	a. BLM	3	30.	Bank cover, % optimum	69
	b. Public c. Private		31.	Bank stability, % optimum	70
	c. Flivate	111			
12.	Total of all stream width		32.	Percent of habitat optimum	
	measurements (ft.)	196			
13.	Total channel width (ft.)	325		Priority B Limiting Factors	
	20002 011111122 112011 (2017)	S 10 1 10 10 10 10 10 10 10 10 10 10 10 1	33.	Average depth of stream (ft.)	0.58
14.	Total widthall pools (ft.	) 101	34.	Average width of stream (ft.)	13.1
15.	Total width of all pools		35.	Average width of channel (ft.)	21.7
	classed 1, 2, and 3 (ft.)	93	36.	Percent of bottom with clinging vegetation (ft.)	5%
16.	Total footage of desirable bottom materials (ft.)	137	37.		
	bottom materials (It.)		57.	rooted vegetation (ft.)	<1
17.	Total spawning gravels (ft.	) 37.5	38.	Percent stream shade	40
18.	Sum of cover ratings	83	39.	Average stream gradient (%)	4.8
19.	Sum of stability ratings	84	40.	Average stream velocity (f/s)	1.5
17.	Sum of Stability facings		41.	Stream discharge (cfs)	7
20.	Elevation: (MSL)	5 T T T T T T	42.	Average water temperature:	1 10
	a. Lowest	4,455		(°F or °C)	10.2°
	b. Highest	4,700	43.	Average Air Temperature	•
21.	Multiple use zones recreati	on		(°F or °C)	8.7° C
	water		44.	Turbidity description (clear)	O JTU
	remote		45.	Access (mi.):	
22.	Number of camera points	_≃9	43.	a. Remote (boat, river) b. Low standard trails	4
23.	Total cost			c. Improved trails	
14 1-	a. Planning			d. Low standard roads	
	b. Salaries			e. Improved roads	
	<ul><li>c. Equipment</li><li>d. Analysis of data</li></ul>		46.	Water quality analysis:	
	u. Analysis of data			a. Hach kit	
24.	Cost per station	-		b. Chemical (BYU) c. Coli (BYU)	

Table 30. Stream habitet survey summary and analysis for Rock

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26. Pool-riffin carlo, 8 opelms _ Fo	
27. Fool quality, 2 options 82	
26. Percent of erress bottors :	
29. Persons opening gravels 19.	
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en Percent of Sabissa option . or	
Can there were a second to the	
33. Average depth of stress (ft.) P. Fil.	(39) Heller Francis Land its
Add (-21) marrie to debte energy At	. C Strain widely made care
the Average width of channel (ft.) 28. F.	
26. Persent of horton with classics (fc.)	
27. Percent of Borows with	
St. Percent surran shour	
30. Sverage cheen study and 1.00	
but average errors valocaty (V/s)   1.5mm	
Al. Reserve discherge (class	
22. A stage velor targets but of A 26.22	
43. Average Air Temperature 8.19 7	
as. Turbishey description folders) 0 200	
45. Access (ala):	
b. Low grandard crafils	
c. language crails	
abel Francis to b	

Table 31. Water quality analysis of Rock Creek.

		29 May 1975	8 July 1975		9 October 1975		
nalysis* by	Test	S-3	S-1	S-3**	S-1	S-3	
	Time		1415	1000	0900	1600	
, 2	Alkalinity, total as CaCO, mg/1	208		221	248	249	
, 2	Alkalinity, total as CaCO <sub>3</sub> , mg/l Bicarbonate as HCO <sub>3</sub> , mg/l	225		269	289	299	
, 2	Boron as B, mg/1			50			
. 2	Calcium as Ca, mg/1	49		42	50	52	
, 2		14		0	7	2	
, 2	Carbonate as CO <sub>3</sub> , mg/1 Chloride as C1, mg/1	2.15	6-2	2.8	4 .	3	
, 2	Conductivity, \u03c4mhos/cm (25° C)	11		500	581	572	
, 2	Hardness as CaCO3, mg/1	218		220	258	269	
	Hydroxide as OH, mg/1	0.04			<0.1	<0.1	
. 2	Magnesium as Mg, mg/1	23	O.D.	28	32	34	
, 1	pH	8.36	8.0	7.8	8.5	8.4	
. 2	Potassium as K, mg/l	0.9		0.9	0.9	1.0	
, 2	Sodium as Na, mg/1	11.8		23	42	37	
, 2	Sulfate as SO <sub>4</sub> , mg/1	23		50	78	74	
1.0	Total Dissolved Solids	267	6.2		352	351	
	Turbidity, JTU's		0	0	0	2	
1 15	Dissolved Oxygen as O2, mg/1	-	9	8			
, 2	Nitrate as N, mg/l	0.33	5. 4	0.03	<0.05	<0.0	
, 2	Phosphate (Total) as P, mg/1	<0.001			-0.03		
, 2	Phosphate (Ortho) as P, mg/1	<0.001		0.04	0.002	0.0	
18	Air Temperature, °C	11.0_ 1	32		3 .	13	
-	Water Temperature, °C		19	14	8	10.5	
14.0	Total Coliform, MPN/100 ml Fecal Coliform, MPN/100 ml		410	700	13-44		

<sup>\*1.</sup> BYU Environmental Analysis Laboratories

<sup>2.</sup> USGS

<sup>3.</sup> Field determinations

<sup>4.</sup> Bionics

<sup>5.</sup> Utah Department of Health and Welfare

<sup>\*\*</sup>All in this column were by USGS

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Table 32. Rock Creek water temperature data--daily minimum and maximum (°C) for 8 July through 21 August 1975.

Date	Min	Max		Date	Min		Max		Date	Min		Max
July 8 9 10	13.5 13.0 13.0	15.0 15.5 16.5		July 23 24 25	11.5 11.5 11.5		16.5 16.0 15.5		Aug. 7 8 9	11.5 10.5 10.5		16.0 15.5 15.5
11 12 13	12.0 12.0 12.0	14.0 15.5 15.5		26 27 28	12.0 11.5 11.5		16.0 16.0 15.5		10 11 12	10.5 11.5 11.0		15.0 14.0 13.5
14 15 16	12.0 12.5 12.5	17.5 16.0 14.5		29 30 31	12.5 12.0 11.5		14.5 15.5 14.0		13 14 15	11.0 11.0 10.5		12.0 13.5 14.0
17 18 19	11.5 12.0 12.0	15.5 16.5 17.0		Aug. 1 2 3	11.0 11.0 10.5		15.5 15.0 15.0		16 17 18	10.5 10.0 10.0		13.5 15.0 14.0
20 21 22	12.5 12.0 11.5	15.5 16.0 16.0		4 5 6	10.5 10.5 11.0		15.5 15.0 15.0		19 20 21	10.0 10.0 10.0		12.0 11.5 14.0
15-day mean	14	.0		15-day mean		13.4	L 9		15-day mean	1	12.3	

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nean 15-day		
	ognorate rentation of	

Table 33. Rock Creek water temperature data--daily minimum and maximum (°C) for May 30 through July 2, 1975.

Date	Min	Max	Date	Min	Max
May 30	4.0	10.5	June 16	5.5	6.0
31	6.0	9.0	17	5.0	6.0
June 1	6.5	13.0	18	5.5	7.0
2	6.5	12.0	19	5.5	7.0
3	6.5	10.0	20	5.0	7.0
4	4.5	11.0	21	5.5	8.5
5	5.0	11.0	22	6.0	12.0
6	6.0	10.5	23	7.0	12.5
7	6.0	9.0	24	7.0	12.5
8	6.0	9.0	25	7.0	10.0
. 9	4.0	7.0	26	5.0	11.0
10	4.0	6.0	27	6.0	11.5
11	4.0	10.0	28	7.0	13.0
12	4.5	10.5	29	8.0	13.0
13	6.5	12.5	30	8.0	13.5
14	7.5	8.5	July 1	8.5	14.0
15	5.5	7.0	2	9.0	15.0
15-day mean		7.6	15-day mean		8.5

Table 33. Rock Creak water temperature data-daily edulant and maximum (°C) for May 10 through July 2, 1975.

		10.5		
7+0				
	55			
	65	0.01	0.0	
	68			
				YSD-EL FILLES.

Table 34. Rock Creek water temperature data--daily minimum and maximum (°C) for September 20 to October 5, 1975.

Date	Min		Max
Sep. 20	7.0		9.0
21	7.0		9.0
22	7.0		9.5
23	7.5		9.5
24	7.5		10.0
25	8.0		9.5
26	7.5		9.5
27	7.5		9.5
28	7.5		9.5
29	7.5		9.5
30	7.5		8.5
Oct. 1	7.5		9.0
2	7.5		9.0
3 /45 4144	7.5		9.0
4	7.5		9.0
5	8.0		9.0
15-day mean		8.4	

reals 34. And Cross weter Competition of the maximum (°C) for September 20 to October 5, 1975.

	26
8.5	
	000. 1

Table 35. Statistics for stepwise pooled samples for Rock Creek Site S-3 on 9 July 1975 and 8 October 1975.

Step*	Total No. of Taxa	Mean No/ft <sup>2</sup>	80% Confidence Limits LL	80% Confidence Limits UL	Standard Deviation	Percent SE of Mean	Coefficient of Variation	פיו	н
9 July 1975 1	18	undefined	undefined	undefined	undefined	undefined	undefined	1.50	1.47
2	19 21	1,463.5 1,410.3	603.2	2,323.8	395.3 294.3	19.1	27.0	1.42	1.40
8 October 1975 1	13	undefined	undefined	undefined	undefined	undefined	undefined	2.05	2.04
3	21	7,240.5 6,756.0	3,092.9 5,027.5	11,388.1 8,484.5	1,905.6 1,587.4	18.6	26.3	2.16	2.13

<sup>\*</sup>Step 1 consists of only one sample; Step 2 is the results from 2 pooled samples; Step 3 is the results from 3 pooled samples, etc.

				Confidence Limits UL
3,092,9				Confidence Limits
				Total No. of Taxa

Table 36. Summary of macroinvertebrate community analysis for Rock Creek on 9 July 1975 and 8 October 1975.

Sampling Site	Number of Taxa	Total X Number/m	% Ephemeroptera	% Plecoptera	% Trichoptera	% Coleoptera	% Diptera	% Other Invertebrates	٦٩	H
S-1 9 July 1975 8 October 1975	14 21	2,928 30,450	20 42	2	4 23	1 1	64 28	9	2.42 2.33	2.31 2.31
S-2 9 July 1975 8 October 1975	19 19	50,195 44,224	1 34	0.4	<b>0.</b> 5 28	0.3	91 32	7 4	1.55	1.54 2.23
S-3 9 July 1975 8 October 1975	21 23	15,182 72,705	2 31	0.4	2 32	0.5	91 33	4 2	1.46 2.20	1.44

		. E Lecophoje Lieus Com
he		A Ephemerontera
25.50 25.50		
		Total K Number/m
		Total K Number/m

Table 37. Number per meter square of macroinvertebrate taxa collected from Rock Creek.

		9 July 1975		8 October 1975		
Taxa	S-1	S-2	s-3	S-1	S-2	s-3
Phylum Platyhelminthes						
Class Turbellaria						
Order Tricladia (Planaria)	0	0	11	0	0	1
Phylum Aschelminthes						
Class Nematoda	0	86	0	0	0	4
Phylum Mollusca			~	077		
Class Gastropoda	0	0	0	377	0	İ
Phylum Annelida						
Class Oligochaeta	151	2,475	312	387	829	46
Phylum Arthropoda						
Class Arachnida						
Order Acarina		005	201	001	761	1 11
Suborder Hydracarina	108	925	301	904	764	1,13
Class Crustacea	11	484	204	97	742	1,24
Order Ostracoda	0	0	0	0	0	1
Order Copepoda	U	U		0	0	•
Class Insecta						
Order Collembola						
Family Poduridae	11	0	0	0	0	
Podura aquatica	11		1000	8,858	111171	
Order Ephemeroptera						
Family Baetidae	592	656	194	12,622	15,107	22,02
Baetis spp. Family Heptageniidae	332	050	2,4	12,022	13,107	22,00
Cinygmula sp.	0	0	0	0	11	177
Epeorus sp.	0	ő	o	0	11	16
Epeorus longimanus	0	32	75	0	0	
Other Heptageniidae	0	0	32	0	0	
Family Leptophlebiidae					2	
Paraleptophlebia sp.	0	0	0	11	0	
Family Ephemerellidae						
Ephemerella doddsi	0	0	0	0	0	:
Other Ephemeroptera	0	0	0	11	0	
Order Odonata						
Suborder Zygoptera	0	ō	0	11	0	
Order Plecoptera						
Family Nemouridae						
Malenka sp.	11	0	0	0	0	
Zapada sp.	0	0	0	0	0	
Family Capniidae	0	0	0	32	54	
Family Taeniopterygidae	0	0	0	54	32	
Family Leuctridae	0	0	0	11	11	13
Family Perlodidae		* 100				
Isoperla spp.	11	43	32	161	463	1,3
Isoperla ebria Family Perlidae	0	0	A	O	0	
Hesperoperla pacifica	0	11	22	22	129	1.
Claassenia sabulosa	32	11	0	0	0	
Other Plecoptera	11	129	11	0	0	

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Animal delete  are property and property  are property and are property  are property and are property  are property and are	24	0	6 6 6	- WE	0 62 63 63 63 6	

Table 37. (continued).

		9 July 197	'5	8 October 1975		
Taxa	S-1	S-2	S-3	S-1	S-2	S-3
Order Trichoptera						
Family Rhyacophilidae						
Rhyacophila sp.	0	0	32	11	0	
Family Psychomyiidae						
Tinoides sp.	22	0	0	0	0	
Other Psychomyiidae	0	0	0	172	0	
Family Hydropsychidae		1 1 1 1 1 1 1		Aller Street		
Hydropsyche spp.	65	215	129	6,854	12,471	22,86
Arctopsyche sp.	22	0	0	0	0	
Family Hydroptilidae			-			
Hydroptila sp.	0	43	0	0	0	
Other Hydroptilidae	0	0	54	75	97	
Family Lepidostomatidae			22	0		
Lepidostoma sp.	0	0	32	0	0	
Family Brachycentridae		0	0		0	
Micrasema sp.	0	11	22	0	0	
Other Trichoptera	0	11	0	0	n	
Order Lepidoptera Order Hymenoptera		**		•		
Family Ichneumonidae	0	0	. 0	0	0	
Order Coleoptera	HE PROPERTY		men to the	T mark to	mm -	
Family Elmidae	22	151	65	420	86	2
Family Dytiscidae	0	0	11	0	0	
Order Diptera						
Family Tipulidae						
Antocha monticola	0	0	0	11	0	
Hexatoma spp.	0	54.	86	54	355	2
Holorusia grandis	0	0	11	0	0	
Family Simuliidae						
Simulium spp.	742	16,409	2,744	3,992	2,981	3,9
Family Chironomidae	1,098	28,805	10,921	4,508	10,749	19,5
Family Ceratopogonidae	43	151	86	43	32	
Palpomyia or Bezzia						
Family Stratiomyidae						
Euparyphus sp.	0	11	0	0	11	
Family Empididae	. 0	54	11	97	0	1
Family Muscidae						
Limnophora sp.	. 0	.11	0	0	32	

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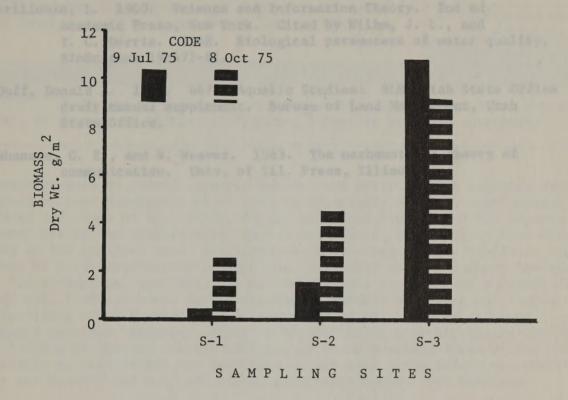


Figure 11. Comparison of macroinvertebrate standing crop (biomass) at three sites on Rock Creek on 9 July 1975 and 8 October 1975.

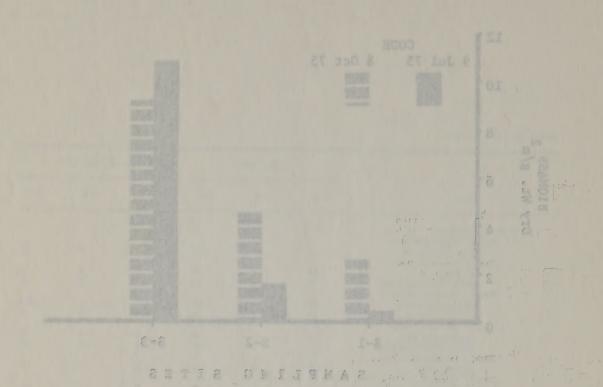


Figure 11. Comparison of marcharacteristing out (blomess) at three sites on Ruck Creek on 9 July 1975 and 8 October 1975.

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## 1. Report No. 3. Accession No. SELECTED WATER RESOURCES ABSTRACTS INPUT TRANSACTION FORM 5. Report Date 4. Title AQUATIC SURVEY OF SELECTED STREAMS WITH CRITICAL HABITATS ON NATIONAL RESOURCE LANDS AFFECTED BY LIVESTOCK AND RECREATION 8. Performing Organization Report No. 7. Author(s) Winget, R. N., and Reichert, M. K. 10. Project No. 9. Organization Brigham Young University, Center for Health 11. Contract/Grant No. and Environmental Studies, Provo, Utah 52500-CT5-1104 13. Type of Report and Period Covered 12. Sponsoring Organization 15. Supplementary Notes Funded by Bureau of Land Management, unpublished final report, 109pp., xi. 37 Tables, 15 Plates, 11 Figures, 5 Maps in separate attachment 16. Abstract These surveys were to provide aquatic habitat and water quality baseline date to the U. S. Bureau of Land Management to be used in evaluating (1) livestock grazing impacts on the flora and fauna of Big, Birch, Thoms, and Trout Creeks; and (2) impacts from recreational use on the potable water supply and aquatic ecosystem of Rock Creek. Included in the analyses are: descriptions of existing aquatic habitats; characterizations of macroinvertebrate communities; and water quality summary for each stream. The assemblage, analysis, and recommendations presented as a result of this study will form the basis for land/water management decisions and future studies involving aquatic habitats and related fauna in these Utah streams. Preliminary analyses indicate: riparian vegetation is probably one of the most critical factors of quality aquatic habitats in small mountain streams; and near optimum riffle to pool ratios are important as too many pools reduce macroinvertebrate diversity and density and too much riffle eliminates needed fish habitats. 17a. Descriptors \*Watershed management, \*Macrobenthos, \*Stream improvement, \*Water quality, \*Coliforms, Bank stability, Land management, Grazing, Cutthroat trout.

## 17b. Identifiers

Environmental Impact Evaluation, National Resource Lands, Critical Aquatic Habitat, Pure Strain Cutthroat Trout, Grazing Impacts, Recreational Impacts, BLM administered streams

17c. COWRR Field & G	oup OGG, OSC			
18. Availability	19. Security Class. (Report)	21. No. of Pages	Send To:	
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